APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

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APRIL, 1951

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- HYDRAULIC CONTROLS
- AIR CIRCUITS
- AIR CONTROLS
- ELECTRICAL AND ELECTRONIC CONTROLS

Presenting the JOINT INDUSTRY CONFERENCE

PNEUMATIC STANDARDS

For Industrial Equipment

IN THIS ISSUE

OIL POWER FOR LOOMS LOWERS UNIT COST OF WIRE CLOTH

TO ROLL OR NOT TO ROLL

WEST COAST COMMITTEE REPORT

BOOSTER SIMPLIFIES WELDER DESIGN

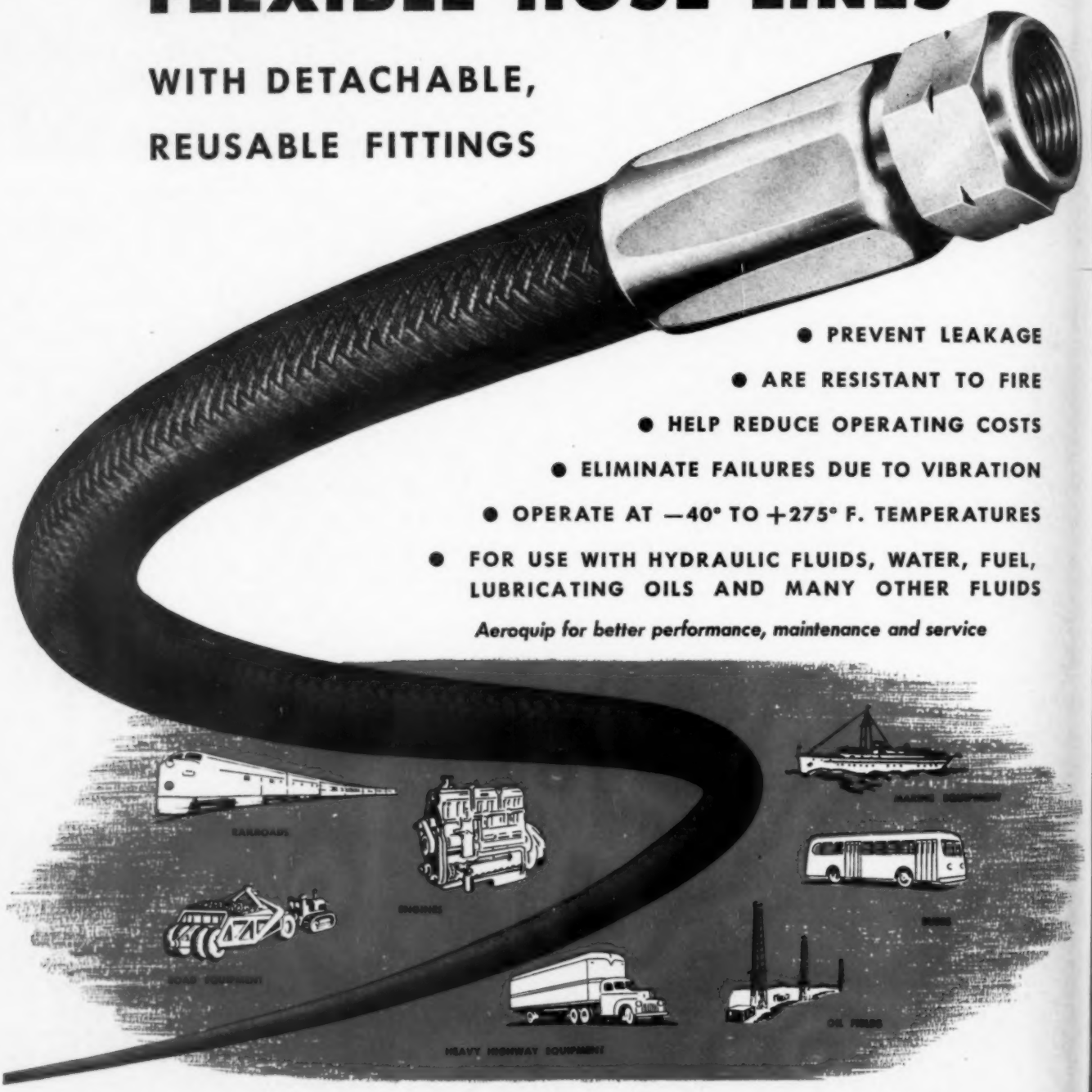
DESIGN OF FLUID BRIDGE VALVES

SCREW AND LOBE PUMPS

Aeroquip

FLEXIBLE HOSE LINES

WITH DETACHABLE, REUSABLE FITTINGS



- PREVENT LEAKAGE
- ARE RESISTANT TO FIRE
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April, 1951 Vol. 4, No. 4

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CONTENTS

Oil Power For Looms Lowers Unit Cost of Wire Cloth 25
By H. E. Kleintop
Wire is woven on automatic machines which have replaced tedious, costly hand labor. Mr. Kleintop describes the design of two looms.

To Roll or Not To Roll 27
Air control of gates in conveyor lines directs the traffic of cartons from branch lines to the shipping platform at S. C. Johnson & Son, Inc.

Booster Simplifies Welder Design 28
A special booster unit in a spot welder provides high oil pressures developed by shop air while using a minimum of circuit components.

BASIC HYDRAULICS SECTION

Hydraulic Pumps 30
Chapter VIII, Part 4, Screw and Lobe Pumps

JIC Pneumatic Standards 34

AVIATION HYDRAULICS SECTION

Design of "Fluid Bridge Valves" 52
By Rodney B. Campbell

Aviation Notes 56

Report on West Coast Committee 58

DEPARTMENTS

Letters to The Editor 10
Literature in This Month's Ads 18
Here's How 32
New Components 60
Useful Catalogs and Bulletins 66
Market Place 71
Post Scripts of Industry 75

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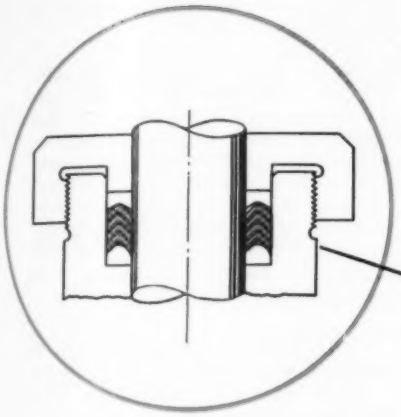
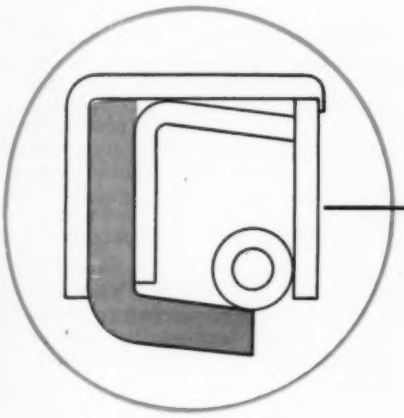


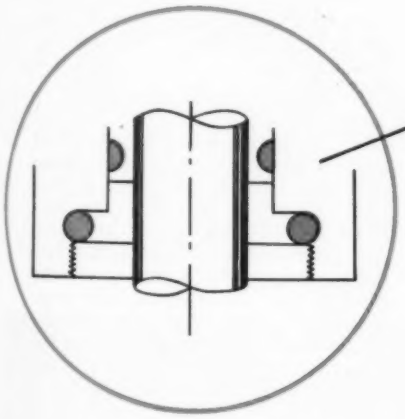
V PACKINGS

V Packings are equally efficient for sealing bores or inside walls of cylinders as they are for sealing shafts or other external peripheries. V packings give equally good performance on either rotating or reciprocating shafts. Leather packings (illustrated), properly impregnated, give long service under high hydraulic pressures and high temperatures. Synthetic V packings are available for exceptional operating conditions.



OIL SEALS

Trostel offers a complete line of oil seals as a cure for your sealing problem. Trained engineers are constantly developing new and better leathers and synthetic rubber to meet unusual operating conditions, and to increase the life and efficiency of your equipment.



O-RING PACKINGS

O-Rings are custom engineered to meet specific design, functional and life expectancy requirements. Trostel O-rings are precision made to assure positive long life sealing under rough use with many different elements, pressures and ranges of temperature.

Trostel offers complete service—design engineering, mold building, and modern production facilities to help you in the solution of your packing problems. A Trostel representative will be happy to call on you at your convenience.

ALBERT TROSTEL & SONS COMPANY

Packings Division

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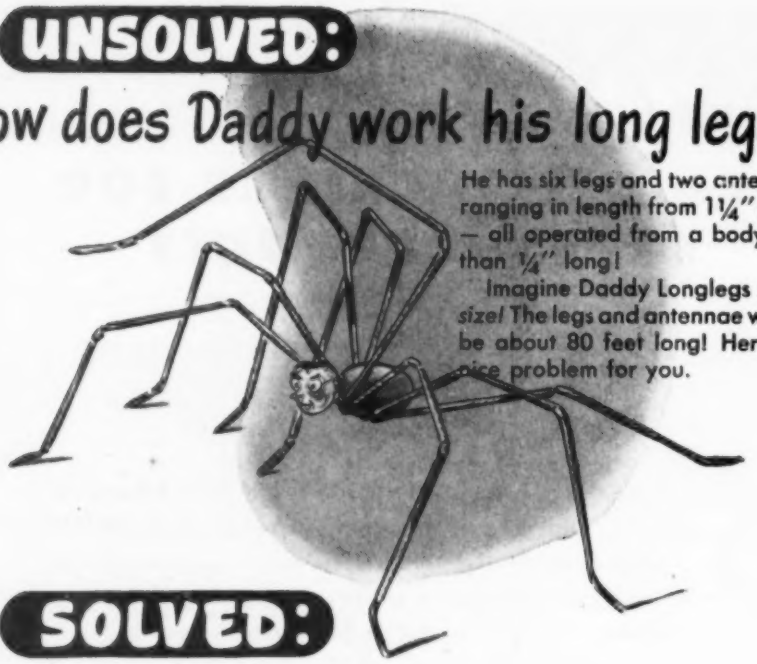
UNSOLVED:

How does Daddy work his long legs?



He has six legs and two antennae ranging in length from 1¼" to 2" — all operated from a body less than ¼" long!

Imagine Daddy Longlegs *man-size!* The legs and antennae would be about 80 feet long! Here's a nice problem for you.

SOLVED:

How a leather or synthetic Vee Packing responds to pressure and lives to a tough old age

Vee Packings are a good example of perfect teamwork, for unlike any of the other standard packing forms, the Vee seldom works alone. The usual team is two — and 6 is not unusual.

Each Vee is a support for the one ahead; therefore, all must be alike in dimension and finish, so that when assembled in sets the lips of each contact uniformly.

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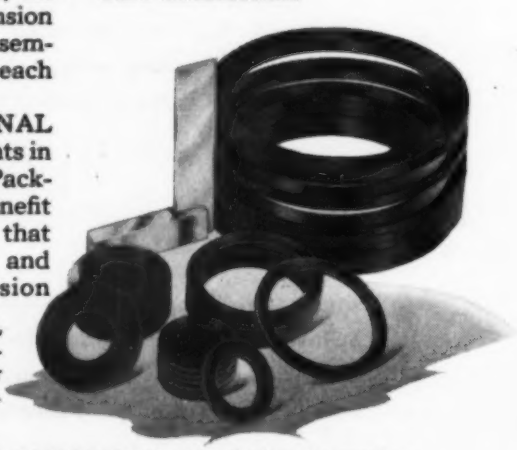

See G&K-INTERNATIONAL for your packing needs in synthetic or leather. Meeting *your* high standard is *our* business.

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GRAKONE AND LEATHER **VEE PACKINGS**

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100 YEARS OF SERVICE TO INDUSTRY

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LETTERS to the Editor

In the December issue of APPLIED HYDRAULICS we noticed an article on page 32 of a mobile earth-auger manufactured by the Sterling Engineering & Manufacturing Company, which seems to be a good application for a hydrostatic hydraulic transmission. Would you give us the address of this company?

J. R. C.

The Sterling Engineering & Manufacturing Company is located at 173 Gilligan St., Wilkes-Barre, Pa.

I have received copies of APPLIED HYDRAULICS magazine and wish to express my gratitude to you for sending these to me, as they are very useful in many ways in overcoming problems in our Australian plant.

R. H.
S. Melbourne, Australia

We are always very happy to learn that APPLIED HYDRAULICS has been useful to practical men, especially where plants are so much on their own.

We have just received your January Directory issue which we found especially interesting. Would you send us two extra copies?

P. W. G.

A rather limited overrun of the January Directory issue was made and we are sending the copies requested. We are able to take care of requests for individual or small lot orders only, which we will be glad to do as long as the supply lasts. Copies of the Directory issue will be furnished at the regular back issue rate.

Is the revised Data List you mentioned in a recent issue ready for distribution? We are particularly interested in practical manuals on electrical components accessory to hydraulic and air systems.

J. L.

The revised Data List is still in process, largely due to the fact that considerable new material is being added. A section on some of the leading manuals

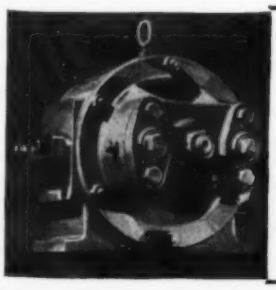
When it's high pressure... it's AMERICAN!

HYDRAMITE...pressures up to 5000 p.s.i.

High pressure capacity is built into the HYDRAMITE... the remarkable new AE radial-piston constant displacement fluid power generator. It has an overall efficiency of 85% without supercharging.

HYDRAMITE is direct-driven through a flexible coupling... rotates in either direction. You've the choice of foot, flange or face mounting.

A product of American Engineering Company, makers of the famous Hele-Shaw Pump, HYDRAMITES are already bringing new efficiency and economy on a wide variety of hydraulically-operated equipment. They are available in 3, 5, and 10 g.p.m. oil capacities.



HELE-SHAW . . . variable pressures up to 3000 p.s.i.

The Hele-Shaw is a radial-piston variable displacement fluid power generator. Pressure and reversal of flow are controlled directly at the pump. Discharge can be varied from zero to maximum... and can be reversed gradually or instantaneously. Suitable controls available. Capacities range from 3¾ to 50 g.p.m. and upward.

VISIT BOOTHS 304 and 305 at ↓

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APRIL 30 - MAY 4 1951

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PHILADELPHIA 25, PENNA.

AE Products include: Hydramite and Hele-Shaw Fluid Power, Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Lo-Hed Hoists, Lo-Hed Car Pullers

American Engineering Company
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Gentlemen: ☐ Kindly send me complete information about the new HYDRAMITE. ☐ Hele-Shaw.

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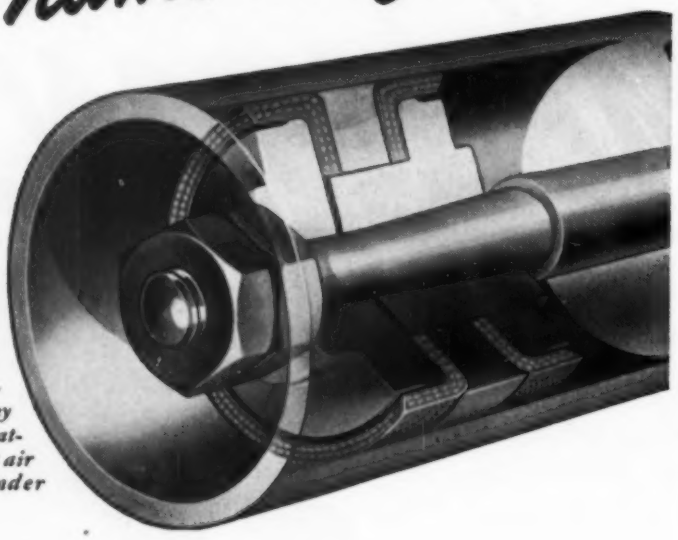
Company_____

Address_____

City_____ Zone_____ State_____

You name the fluid...



Phantom cutaway showing typical Pumcup-piston assembly—one of many types for all reciprocating pumps as well as air or hydraulic cylinder mechanisms.

Here's how to pump it at lower cost!

IN thousands of plants, Darcova Pumcups are solving the problem of diminishing pump efficiency, repacking, maintenance, down-time, lost production—the things that really eat up dollars in fluid-handling operations!
Here's why . . .

1. Darcova composition Pumcups not only increase volumetric efficiency, but they *keep* it high with no appreciable fluid slippage for the entire life of the Pumcups.

2. And, because of their design, composition, and operating principle, Pumcups have *many times the life* of most other types of piston packing.

3. Based on years of application research, Pumcups come in standard and special compositions for exceptional stability in handling almost *any* fluid you can name. For example . . . strong acids and alkalies, food products and even the most troublesome petroleum derivatives.

Big savings? We'll gladly refer you to Pumcup users whose problems are similar to yours. *They'll* tell you! Meanwhile, send for a free bulletin containing helpful, more detailed information: Bulletin 4401 on Pumcups for reciprocating pumps; Bulletin 4502 on Pumcups for air and hydraulic mechanisms. Just write to . . .

DARLING VALVE
and Manufacturing Co.
WILLIAMSPORT 15, PA.

DARCOVA
THE ORIGINAL COMPOSITION CUP

PUMCUPS

(Continued from page 10)

which treat practical phases of relays, limit switches, timers, switches and other electrical components will be included. Your name is filed for the purpose of advising you when the new list is ready for distribution.

In the June issue of APPLIED HYDRAULICS there was mentioned a "Recommended Good Practice Manual" as in preparation. We would appreciate your advising the writer if this manual has been published and how a copy can be secured.

J.A.M. JR.

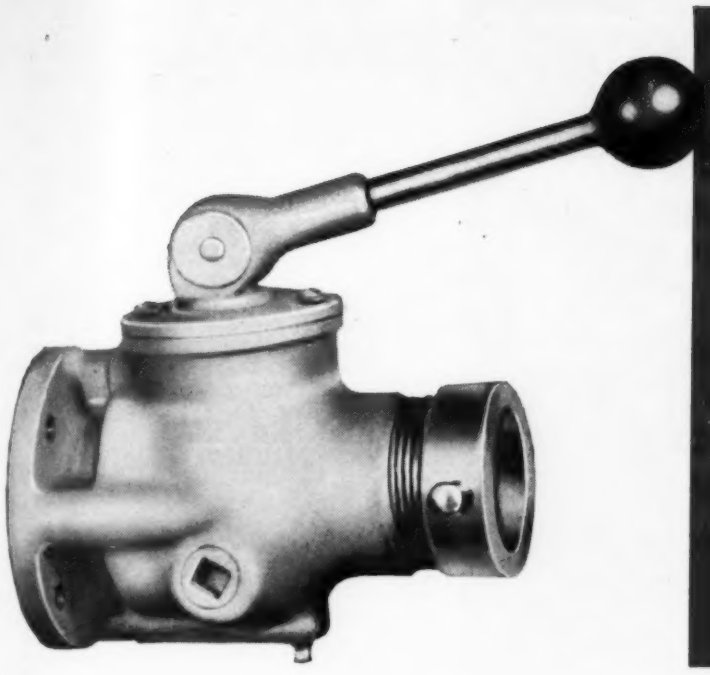
The "Recommended Good Practice Manual" is an engineering project of considerable magnitude which was undertaken by the Southern California Section, ASME approximately two years ago. There is a brief report on the progress of this Manual in the Aviation Section of this issue.

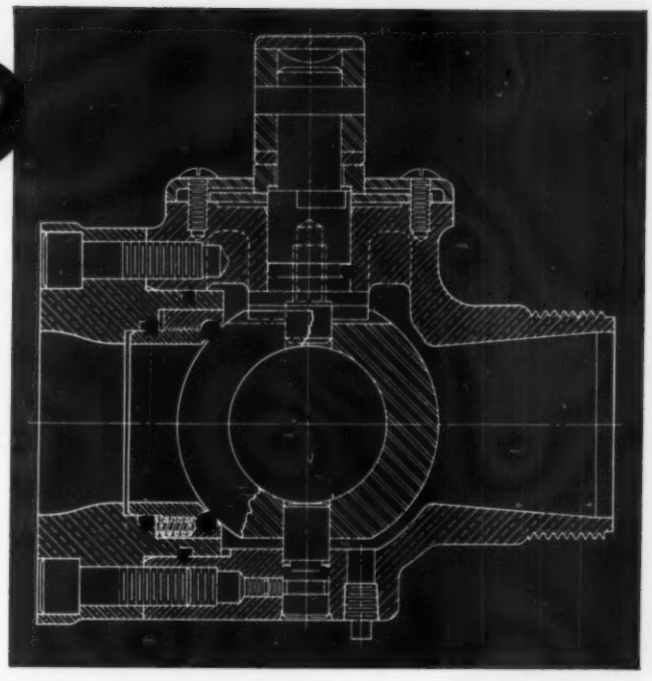
As a practicing engineer doing his best to keep up with some of the major new developments I have batted my head against a stone wall on the subject of servomechanisms. Isn't there one of the engineering schools or possibly a leading manufacturer who might be encouraged to offer a practical short course on servos?

F. B.

Up to the past week our only answer would have been to shake our head and sympathize with you. However, we have just learned that a two weeks course in Hydraulic Power Control will be offered by the Summer Session of Massachusetts Institute of Technology, July 9-20. The sessions, under Professor John A. Hrones, director of the M.I.T. Dynamic Analysis and Control Laboratory, will survey problems of theory and practice confronting engineers in this field placing special emphasis on recent developments which make possible greater accuracies and speed of response. According to the preliminary announcement, is intended chiefly for practicing engineers and will be open to those who have no previous formal training in the hydraulic field. A fuller announcement of the course will be given in the next issue of APPLIED HYDRAULICS.

I go over all the circuits you publish with the application stories you run in APPLIED HYDRAULICS but I would like to protest that sometimes the story is incomplete without the electrical or wiring diagram. As I see it the elec-





TIP . . .

FOR THE DESIGNER

Simplified Construction and Self-Adjusting too! with . . .

LINEAR PRECISION MOULDED "O" RINGS

The Waterous Company has capitalized on the merits of LINEAR "O" Rings in the advanced design of its Model 49B Gate Valve.

A total of five different LINEAR "O" Rings are used in this unique valve . . . simplifying construction and eliminating the irreparable wear of normal seat design. "O" Ring applications include: one as a rotary joint on the upper stem; two as static seals; one as a packing for the seal ring; and one as a self-adjusting valve seat.

This incorporation of LINEAR "O" Rings has resulted in considerable cost reduction . . . plus longer, more satisfactory service for the valve which must handle water at pressures up to 500 psi. at capacities up to 500 gpm.

LINEAR "O" Rings are compounded of natural or synthetic rubber, fluorethylene polymers, and silastics . . . are available in a complete range of J.I.C. and A.N. standard sizes, as well as hundreds of non-standard sizes for special uses.

"PERFECTLY ENGINEERED PACKINGS"

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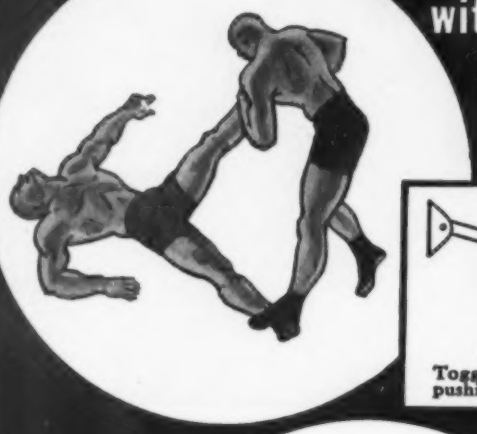
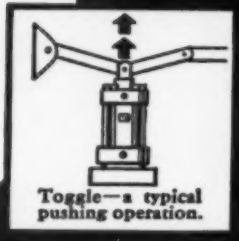
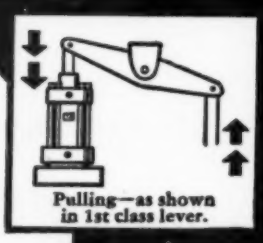
Rasslin' with HIGH COSTS?

SAVE on "MUSCLE JOBS" with T-J CYLINDERS

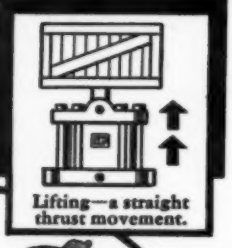




Toggle—a typical pushing operation.



Pulling—as shown in 1st class lever.



Lifting—a straight thrust movement.

Air or hydraulic power—applied by T-J Cylinders—gets an amazing lot of tough jobs done for industry . . . *faster, more efficiently,* and *at lower cost!* Check your plant operations and machines *now* — make a note of mechanical movements that can be simplified and speeded up with T-J Cylinders! Designed for a wide range of pushing, pulling, lifting, clamping or control jobs . . . 100 lb. or 50,000 lb. Many standard sizes and styles . . . both cushioned and non-cushioned types . . . precision-built, dependable. Write for additional information. The Tomkins-Johnson Co., Jackson, Mich.

35 YEARS EXPERIENCE (T-J)

TOMKINS-JOHNSON

RIVETORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

(Continued from page 12)

trical circuit is just as much a part of the installation as the oil or air circuit.

P. K. B.

You are right, of course, and we are planning, wherever possible, to include the wiring diagram as a part of the oil or air systems which we publish.

Page 32 of your February issue showed an application of a hydraulic hoist in a bakery. One of our clients, the Globe Hoist Company, manufacturers hoists of this type and we are wondering whether this might be one of their installations.

J. C. W.

The letter below answers your question.

We (Rotary Lift Company, Memphis 2, Tenn.,) notice in your February issue you have two very good pictures showing the use of our hydraulic lifting equipment. One of these pictures, in the upper left hand corner of page 32 shows our Dough Trough lift for bakery service and the other picture in the lower right hand corner of page 33 shows one of our Levelator lifts being used to feed a hot plate press.

C. B. B.
Elevator Division

The article "Fluid Power Gives Muscles to Material Handling Equipment" was one of a series being published to show application ideas of specific types of equipment to a wide range of uses throughout industry. Other articles are in preparation or planned to cover other types of equipment and their representative uses.

It may interest you to know that APPLIED HYDRAULICS is read with great interest in this country, where we have no magazine devoted entirely to the subject. We get more technical articles on hydraulics in APPLIED HYDRAULICS in one month than in all the rest of the technical press, and the series on "Basic Hydraulics" are very good for youngsters who will qualify for technical positions when they have gained the necessary experience. As a matter of interest, I am employed as a designer by Dowty Equipment Ltd., Cheltenhem, England.

E. H. B.

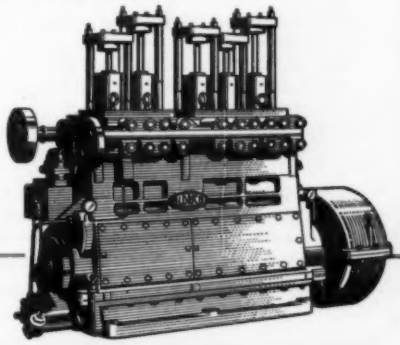
Thanks for the nice things you write about APPLIED HYDRAULICS. The very gratifying support and encouragement which the hydraulics industry has given to us has enabled us to make a good start in serving this industry and we pledge our constant effort to improve and widen our ability to be helpful. "Basic Hydraulics" has been very popular with our readers.

It's the short way home . . . when the high road means a straight line and a through-flow of traffic. It means too that you can get more work done today . . . and still more tomorrow.

Designed to give virtually the same results, the Aldrich Direct Flow Pump passes liquid *directly* through the working barrel. Aldrich design engineers have successfully eliminated two right angle turns in the fluid-end block.

This design, resulting in a reduction of "loss space", means more work done at less cost. Volumetric efficiency is improved and materials are saved. In each size, you get a smaller pump that does the same work better . . . which is why more people are coming to Aldrich for pumps made in 3", 5", 6" triplex; 5", 6" quintuplex and 5", 6" septuplex units . . . to meet medium-to-high pressure and capacity requirements.

Applications where Aldrich Direct Flow Pumps are operating today include: hydraulic systems for press operation; plastic and rubber molding and extrusion; steel mill descaling, and other uses in the petroleum and chemical industries. Request Data Sheet 64.



THE ALDRICH PUMP COMPANY

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Regardless of service, Palmetto Kup is always a "special"—ready to be tailored to the performance you specify.

No one packing can be all things to all service conditions. Temperature, pressure, motion, speed, the fluid handled—a variation in any one of these factors at once produces a new situation with which a packing must contend. Accordingly, Palmetto Packing Specialists have avoided "off-the-shelf" answers in filling even standard cup packing needs.

Whatever the service, each Palmetto Kup is built with a "personalized capacity" achieved through use of the one suitable fabric and one proper packing compound that match your application.

THE KUP THAT WON'T CRACK— AND NEVER RUNS DRY!

Fig. 1

Fig. 2

Though the service condition (see above) may suggest other structure, Palmetto Kup ordinarily is constructed as a sandwich. A disc of the prescribed synthetic rubber compound (see Fig. 1) is placed between discs of fabric which have been impregnated with the special compound. When pressure and heat are applied in molding, a complete bonding action takes place, producing a resilient, strong, uniformly reinforced product (see Fig. 2).

Kup will not "dry out" under stress of heat—or from non-use during shutdown periods . . . an important factor in air cylinder design.

Palmetto Kups are stronger at the heel because Kup fabric, cut on the bias, takes shape snugly, does not distort, so retains full strength—eliminates most common cause of failure.

We invite your inquiry. Write for complete details.

PALMETTO Packings *Specified since 1880*

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NORTH WALES, PENNSYLVANIA

Circle 16 on Reader Service Card

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

SWIVEL JOINTS—Developed for hydraulic systems, the Barco Manufacturing Co. offers engineering recommendations to assist in the application and selection of swivel joints.

Circle 41 on Reader Service Card

OIL FILTERS — Free literature describes the Hilliard Corporation's line of filters for industrial use.

Circle 38 on Reader Service Card

ROD WIPER — To provide protection to cylinder rod, spindles and pins, Hydraulic Accessories Co. has available descriptive literature on their metallic rod wiper.

Circle 44 on Reader Service Card

CONTROL VALVES — Catalog 546 describes the W. H. Nicholson line of valves for pressures to 5000 psi.

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REUSABLE HOSE ENDS—You can get complete details on hose assemblies and reusable hose ends in Catalog H-1451-A offered by The Weatherhead Company.

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POWER CYLINDERS — For both air and oil power jobs using cylinders, Tomkins-Johnson has prepared catalogs giving size, installation and application data.

Circle 12 on Reader Service Card

SOLVE PUMPING PROBLEMS—That's the title of an informative booklet prepared by Geo. D. Roper Corporation. Typical examples are worked out, valuable tables are included.

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SAFETY VALVE—Is the name of Ross Operating Valve Company's new air valve. The construction features which assure safe operation are described in available literature.

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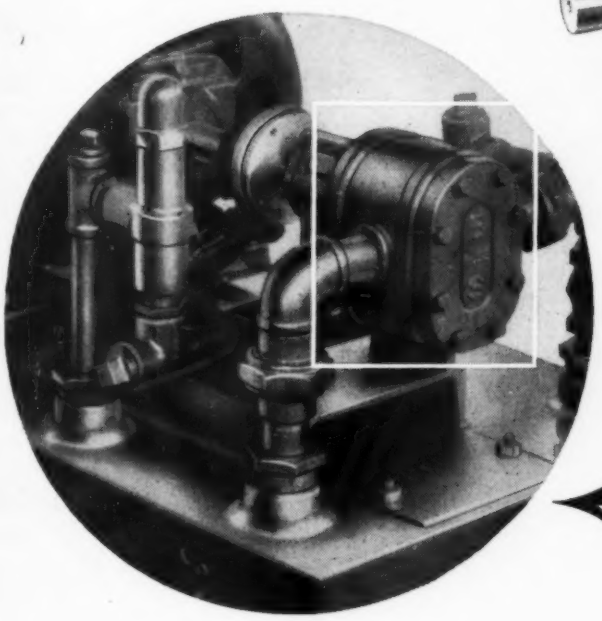
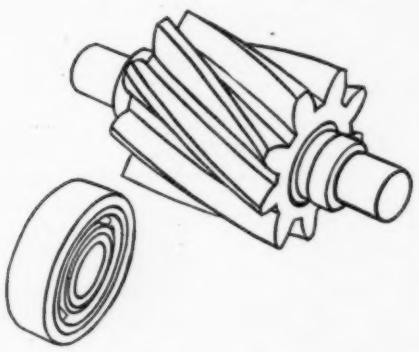
Stock Pumps with "Custom-Made Performance...



for hydraulically-operated machines

Nos. 53 and 55
ROTARY GEARED PUMPS
with Helical Gears and Roller Bearings



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Designed with extremely accurate helical gears and roller bearings, Brown & Sharpe No. 53 and 55 Pumps have served as standard equipment for low-pressure hydraulic systems on a wide variety of machines, such as stokers, shoe machinery and machine tools and also for many transfer applications.

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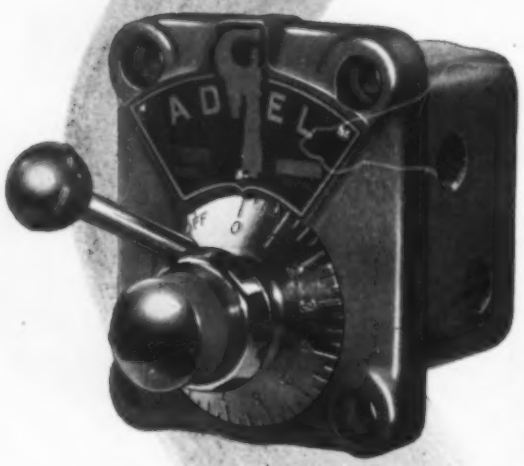
FLOW CONTROL VALVE FOR VERSATILITY



Adjustable from completely shut off position to 25 G.P.M. maximum flow. Will maintain constant fluid flow and constant machine feed over a wide range of pressures and feed resistances.
The diagrams show but two of innumerable circuits and systems where this versatile and better valve can be used to advantage.

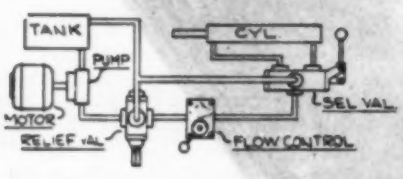


Diagram illustrates typical circuit showing control of cylinder.

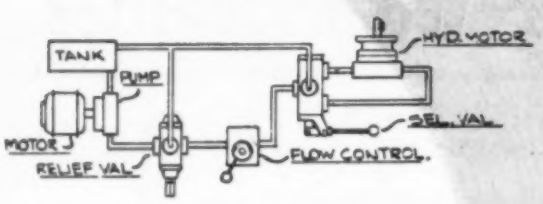


Diagram illustrates typical circuit showing control of hydraulic motor.
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CHARACTERISTICS

1. Valve is compensated type which maintains substantially a constant flow regardless of variation in inlet and outlet pressure.
2. Maximum recommended inlet pressure 1500 P.S.I.
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Circle 18 on Reader Service Card

LEAKPROOF CHECK VALVE — Engineering data will be supplied detailing James-Pond-Clark's Circle Seal check valves for pressures to 3000 psi.
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PILOT OPERATED HYDRAULIC VALVE—Literature describes the C. B. Hunt, "Quick-As-Wink" valve for systems to 5000 psi.
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"O" RING DATA — Plastic Rubber Products Company has available a complete engineering catalog which will assist you in selection of seals and design of parts using "O" ring seals.
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HIGH PRESSURE AIRCRAFT PUMP—Performance chart and specification detail the Pesco "pressure loaded" gear pump delivering 3 gpm at 3000 psi.
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FLUID POWER TRANSMISSION — If your problem involves a machine drive requiring variable speed, The Oilgear Company will supply data on available drive units.
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AIR VALVES—Engineering drawings and complete data on all Hi-Cyclic valve models built by Beckett-Harcum Company are offered.
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FLUID MOTORS—Full particulars are offered describing the Berry hydraulic power transmission systems.
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LINE AND SUMP TYPE OIL FILTERS—Catalogs 104 and 202 are offered by Marvel Engineering Company. They give construction and original equipment application data on Synclinal Filters.
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QUICK-CONNECT COUPLINGS—Hansen Manufacturing Company offers a catalog giving complete range of types and sizes for fluid line couplings.
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DARCOVA PUMPCUPS—Designed for reciprocating pumps and air and oil cylinders, these packings are described in Bulletins 4401 and 4502. Darling Valve and Manufacturing Co. has prepared these bulletins to show actual performance data.
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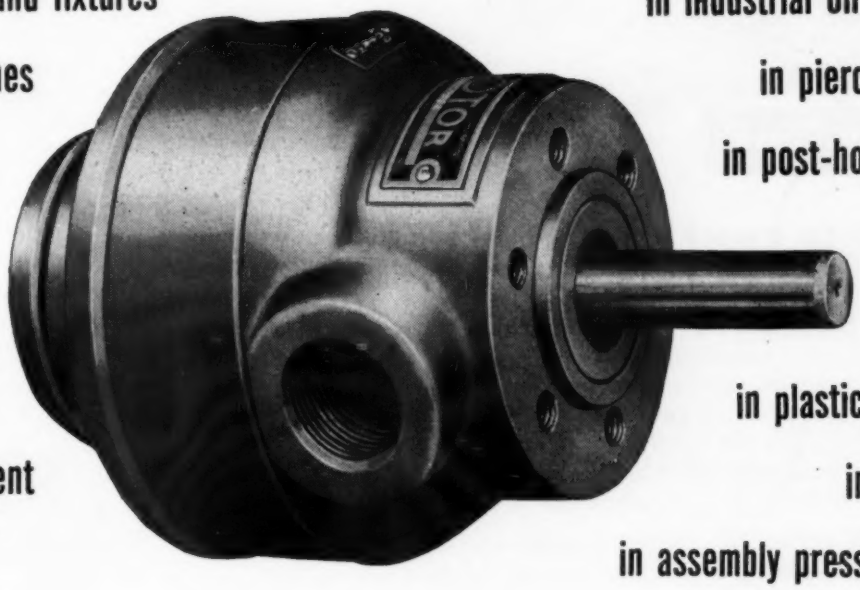

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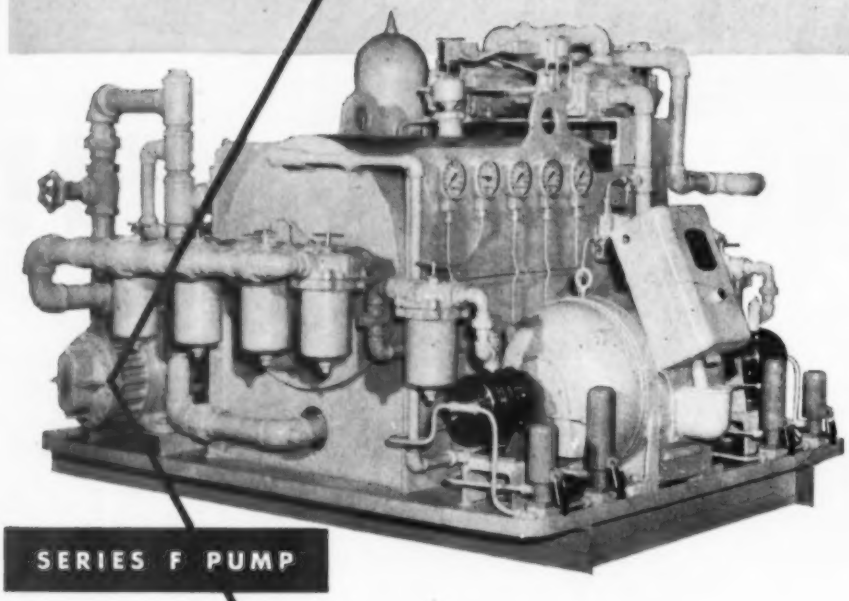

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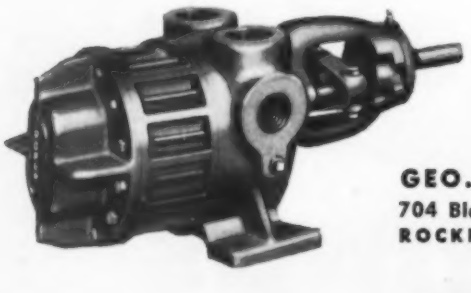
ROPER PUMP QUICKLY CHARGES THE CIRCUIT IN THIS SECO UNIT

This Seco Fluid Power Package has all the essential components for automatic high-low hydraulic press operation. In this application, a fast-acting Roper Series "F" Pump is used as the low pressure generator; it supplies power to the circuit which closes the daylight opening of the press ram. Because the Roper Pump and a Seco pump operate intermittently, it is possible for the unit to operate two or more presses alternately.

Roper Series "F" Pumps feature 4-port design giving eight optional piping arrangements; are supplied in standard or stainless steel fitted models; come with or without relief valve, with mechanical seal or packed box. Pressures to 300 P.S.I. — Capacities 1 to 300 G.P.M. Perhaps you, too, have a hydraulic application which calls for the installation of a *dependable* Roper.



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ROPER
Rotary Pumps

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Circle 50 on Reader Service Card

BENCH AIR PRESSES—Using Air-Mite single or double acting cylinders, small, flexible bench presses are described in a complete catalog.

Circle 58 on Reader Service Card

POWER CYLINDERS — Bulletin 731 gives complete details on standard Lindberg air cylinders. Sizes, mountings, pressures and weights are tabulated.

Circle 72 on Reader Service Card

PRESSURE BOOSTER — Miller Motor Bulletin B-200 details their unit for boosting shop air pressure to high pressure hydraulic power.

Circle 5 on Reader Service Card

PACKING PROBLEMS—Albert Trostel & Sons Co. offers design engineering, mold building and modern production facilities. An informative brochure is available.

Circle 7 on Reader Service Card

CYLINDERS — Both air and oil cylinders are detailed in available catalogs prepared by the Hannifin Corporation. Bulletin 110 describes hydraulic and 210 illustrates sizes, mountings and applications of pneumatic cylinders.

Circle 46 on Reader Service Card

HOSE COUPLINGS — Write on your letterhead to Anchor Coupling Co., Inc. for Bulletin 48 describing their ductile sleeve hose couplings for high pressure oil systems.

Circle 61 on Reader Service Card

ELECTRIC MOTORS—Widely used to drive hydraulic pumps on industrial machines, Lima electric motors are illustrated in available literature.

Circle 47 on Reader Service Card

STOP DOWNTIME—To assist you to protect hydraulic equipment, Honan-Crane Corporation has prepared an interesting bulletin which tells how oil purifiers reduce operating costs.

Circle 34 on Reader Service Card

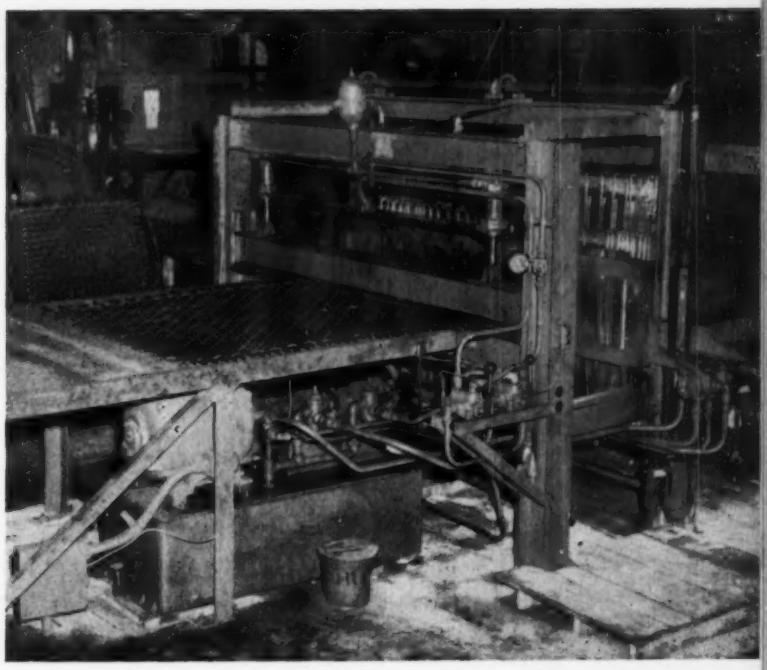
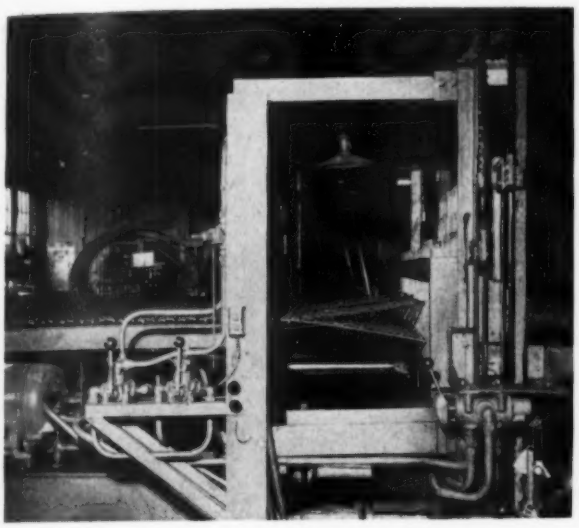


Fig. 1. General view of the large loom showing clamps, accumulator and the protected, convenient location of the motor, pump and tank.

Fig. 2. A closeup of the operator's side of the large loom showing the three hand operated valves, and the carriage type lay-bar.



By H. E. KLEINTOP
Industrial Designer
Parkesburg, Pennsylvania
Chief Engineer,
Korb-Pettit Wire Fabrics
and Wire Works, Inc.

OIL POWER FOR LOOMS

Lowers Unit Cost of Wire Cloth

THERE HAVE BEEN MANY PROBLEMS INVOLVED IN the weaving of industrial screens that made them difficult to produce at a profit and to price the final product at satisfactory competitive levels. In grades involving materials ranging from fairly heavy gauges of wire to rods of ⅞ in and often in hardnesses that presented severe working problems, the very high percentage of hand labor required kept production at a low level as well as resulting in a high unit cost.

New wire cloth looms, especially designed to utilize hydraulic power, have proven very satisfactory for Korb-Pettit Wire Fabrics and Iron Works, Inc., in their Philadelphia plant. Two looms were built, the first designed to handle only the heavy grades of screening, grades which formerly were hand assembled by bench labor.

The loom was designed to weave screens ranging from ½ in square openings using ¼ in diameter plain steel rods to 2 in square openings using ⅝ in diameter oil tempered spring steel rods. The width of the weave is 8 feet.

This loom, Figures 1 and 2, uses a carriage type lay-bar to provide a straight line drive for the fill-wires and is capable of striking a sharp blow as well as providing a slow, powerful push-type of stroke. This design allows latitude for placing the fill-wires without damaging the warps, or long-wires, regardless of conditions encountered in weaving a wide variety of specifications of

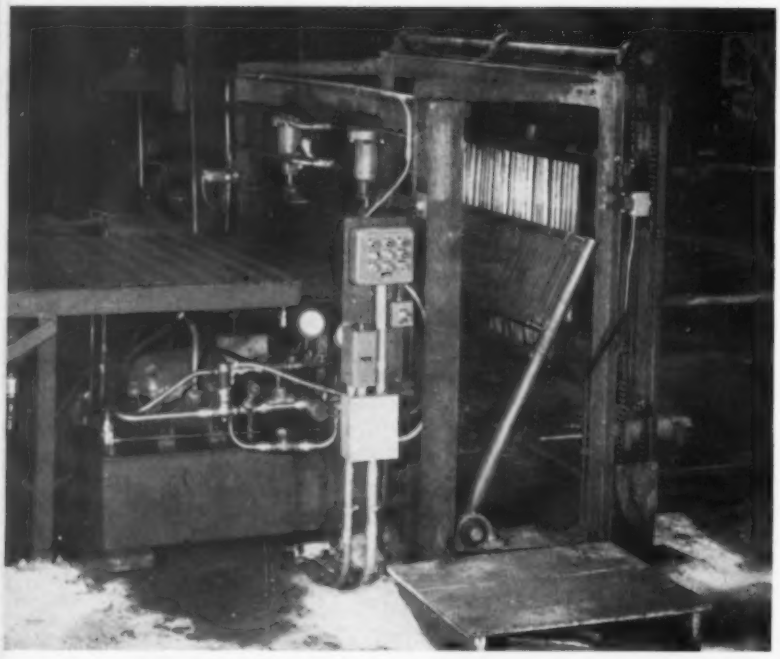
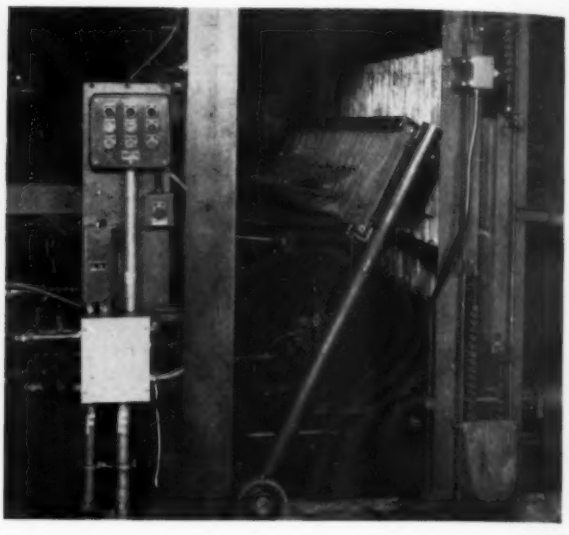


Fig. 3. The small loom with the push button control station from which solenoid operated valves can be actuated either manually or automatically.

Fig. 4. Closeup of the small loom showing the essential simplicity of operation of the rocker type lay-bar.



cloth using wire and rods of varying degrees of hardness.

A double internal gear pump supplies oil to operate cylinders which actuate the clamp, shade and lay-bar. The larger volume supplies the lay-bar cylinder; the smaller supplies the clamp and the shade. Three control valves (Figure 2) are hand operated, one each controlling the lay-bar, shade and clamps. Since the clamps are on one supply line, flow control valves are used to balance pressure and coordinate operation. An accumulator is used to assure a tight clamping hold while other components in the circuit are in operation.

Design an Automatic Loom

The operation of this loom has provided many times the former productivity without the need for additional labor.

As a result of the success experienced with the first loom, a second unit, designed for weaving lighter specifications of wire cloth, was built and put in operation.

This loom is lighter and faster than the first and capable of more flexibility in its application to the scope of work to be done.

This unit is presently handling cloth specifications varying from ½ in space using ¼ in rods to 4 mesh per inch of 2 gauge (W&M) wire in metals from plain steel to oil tempered spring steel. The width of the weave is 7 feet.

A rocker type of lay-bar, operating from the base of the loom, is used so that the stroke can be completed much more rapidly than that of the lay-bar used on the larger loom.

Electrical Control of Valves

Instead of using hand operated control valves, this machine employs solenoid operated valves with push button control for manual operation. An alternate arrangement provides for automatic cycling of the various operations. Automatic operation is used for specifications with light gauge warp wires, the piece moving up after each fill wire is driven into place. This of course, requires that automatic clamping and unclamping must be included, as well as the functions involving shade changing and lay-bar operation.

Contrary to expectations, the operator after becoming accustomed to handling the push button control station, was able to weave specifications, which normally required manual operation of the push button station, as rapidly as specifications in the automatic category.

These looms, replacing a combination of bench labor and hand loom labor, have enabled this company to greatly increase their output without additional labor. Mediocre delivery possibilities have been replaced by prompt schedules; all this has been possible at a nominal cost for the machines as well as a low operating cost.

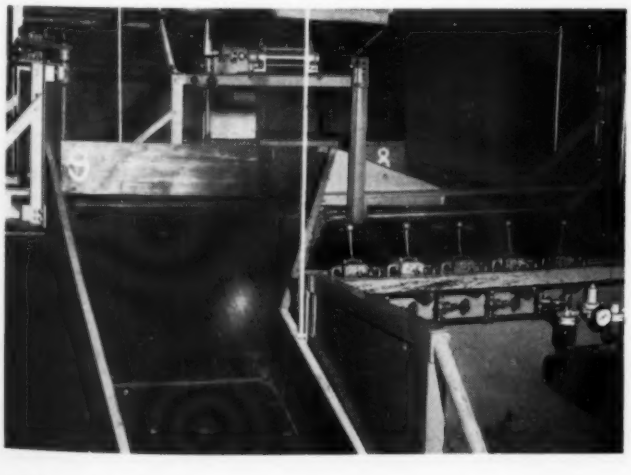
Packed cartons of Johnson's wax products move on roller conveyors out of many branch lines to the main dock conveyor. Using air power to open and close traffic from each branch, an operator directs the right cartons to fill each shipment.

To Roll or Not to Roll

IN THE PLANT OF S. C. JOHNSON & SON INC., Racine, Wisc., world famous manufacturer of waxes, a large percentage of the sealed and imprinted cartons are delivered on conveyors directly to railway car or truck loading platforms. This means that a number of different products and packages are constantly being fed into main conveyor lines and being separated out for the always changing makeup of a given shipment. This problem is being taken care of very simply and directly by air operated shutoffs and gates at key points in the plant.

A relatively simple conveyor system is possible for two principal reasons. First, the flow of manuacturing and packaging operations is arranged so that the materials. the containers and the shipping packages move in one path through the plant. Second, the range of shipping container sizes is somewhat narrow, in spite of the sizes of individual packages or cans, so that one type and size of conveyor can be used for practically all of the products prepared, packaged and shipped.

Feeder conveyor lines pickup and carry individual product packages to main transportation conveyor lines. At such traffic points and at similar points where specific numbers of specific product packages are shunted from main conveyor lines to shipping points, the air operated shutoffs and gates have provided a very good control which, in effect, has simplified the problem of handling and loading.



A typical incoming traffic point is illustrated in Figure 1. One operator, by opening and closing levers of a bank of air valves, can block off or open individual feeder lines to the main conveyor. Vertically mounted air cylinders below the plane of the feeder conveyors, extend to raise an obstruction across the path of the conveyor line. The approaches to the main conveyor lines are roller conveyors, so that the packages bank up behind the obstructions. The operator removes the obstruction by reversing the air valves by a lever movement. In this way the traffic point operator controls the flow along the main conveyor. He not only levels out uneven volumes of package flow from feeder lines but he is able to "spot" flow in a pattern desired to make up a loading schedule.

A second type of traffic control is shown in Figure 2. Here the operator has the same type of control by means of a bank of air valves. However, here the cylinders are mounted above the level of the conveyor lines to operate vane type gates to bleed off package traffic to branch lines which travel to loading points. Standard four-way air valves and double acting air cylinders are used and the installation is relatively simple.

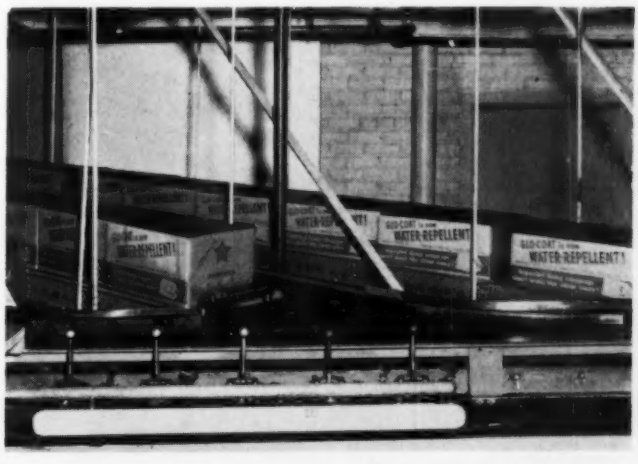


Fig. 1. Each air valve controls the flow of cartons from a branch feeder line.

Fig. 2. Air cylinders, actuated by the manual valves open and close vane type gates.

For many designs where the complete cycle of operation is simple straight-line travel, booster cylinders can provide the necessary power requirements with considerable savings in components and construction.

Booster Simplifies Welder Design

USE OF AN AIRDRAULIC CYLINDER ON A SPECIAL spot welding machine, built by the Federal Machine and Welder Co., Warren, Ohio, permits the use of smaller gun units and reduces the number of components in the power circuit.

The design provides the many conveniences of operating with air as well as the smooth and powerful action of oil. Shop air supplied at approximately 80 to 100 psi is the only outside power source for positioning the work and moving the welding guns.

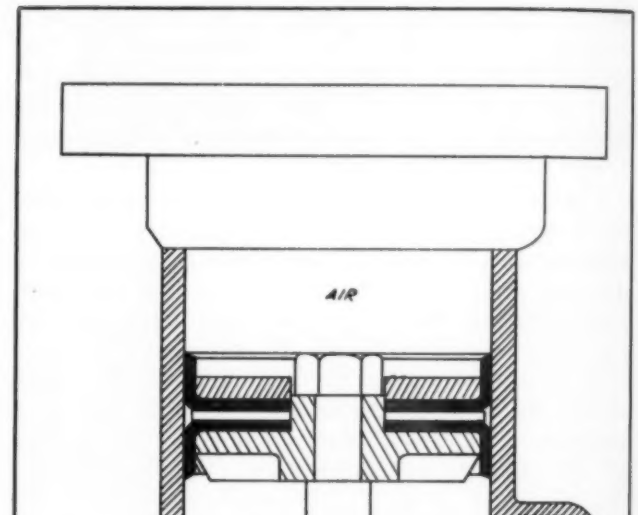
Built to spot weld a sub-assembly of an automotive type air cleaner, this 6 point gun unit has a production output of over 600 units per hour.

The welder consists of a fabricated steel frame which supports three welding transformers to supply welding heat; six hydraulic guns actuated by the airdraulic cylinder, carry the welding electrodes and apply welding pressure; an air operated ram in the lower frame supporting the work holding die and locators; and the necessary electrical and mechanical controls for efficient operation.

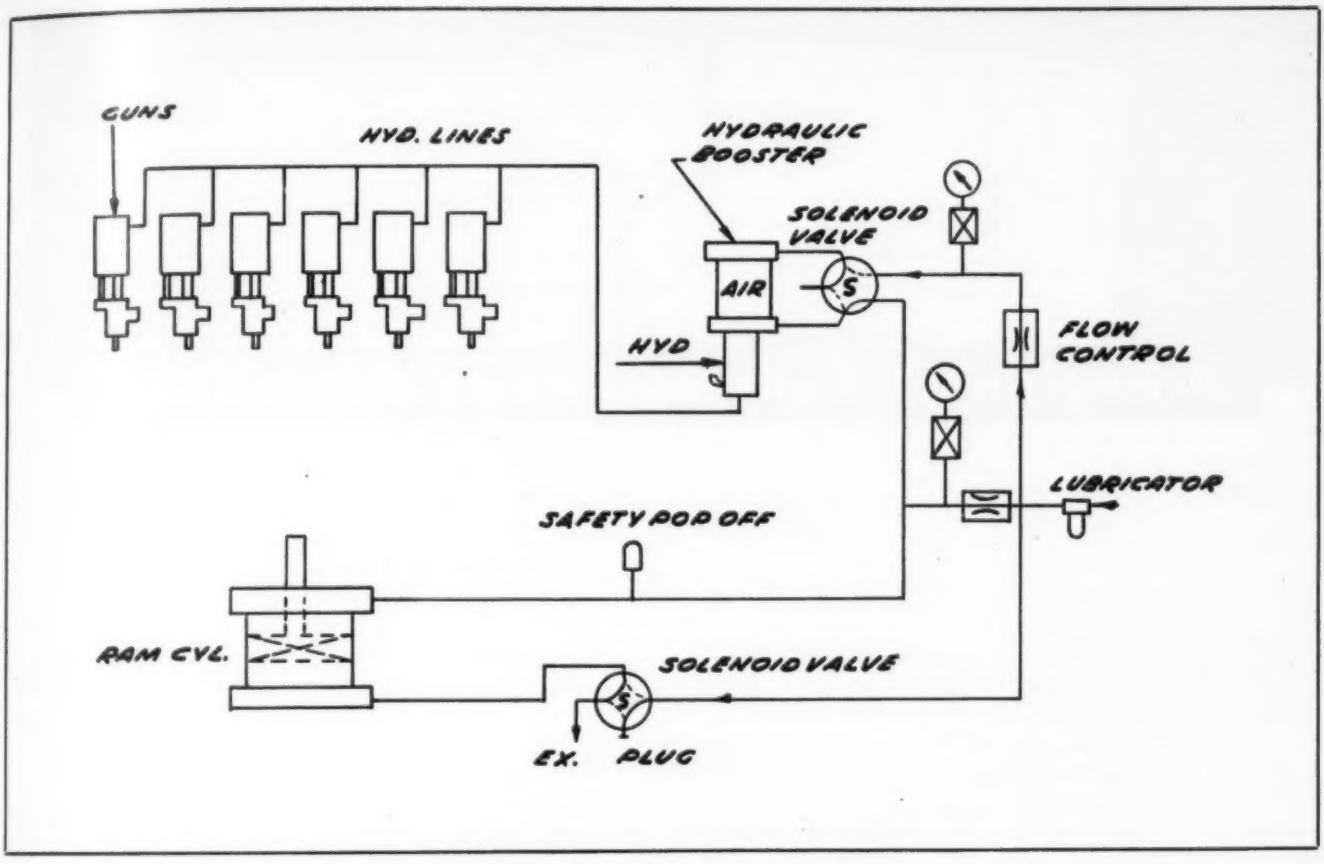
Welds are made on this machine by the "series" method, current flowing from one gun, through the work to the shorting die, and back through the work to the next gun.

Ease of Operation

The operator places the work in position in the dies and depresses the pushbuttons to energize the air solenoid valve, admitting air to the blank end of the ram cylinder, causing the ram to raise to welding position.



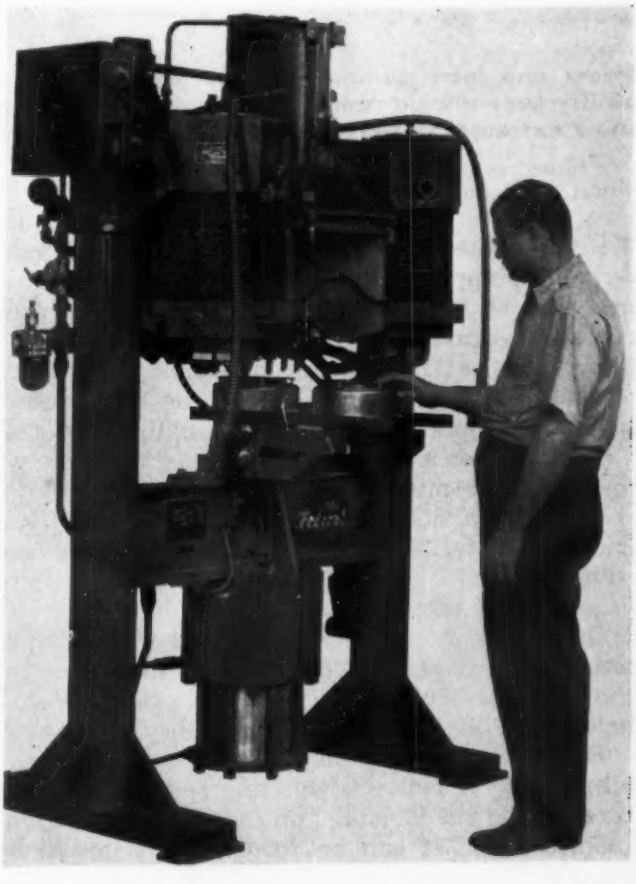
This special booster cylinder was built for the spot welder. Air under 80 psi is applied to the head end of the cylinder. Oil supplied to the rod end, from the built-in reservoir, powers the vertical motion of the welder guns. Oil pressure can reach 1200 psi. The booster piston has a stroke of 3½ in, displacing 4.29 cu in from the 62 cu in capacity reservoir.



Simplicity of this air circuit has resulted in compact machine design. A high pressure system, which in previous designs included hydraulic pump, tank, valves and piping, has been reduced to the essential power cylinders and control valves.

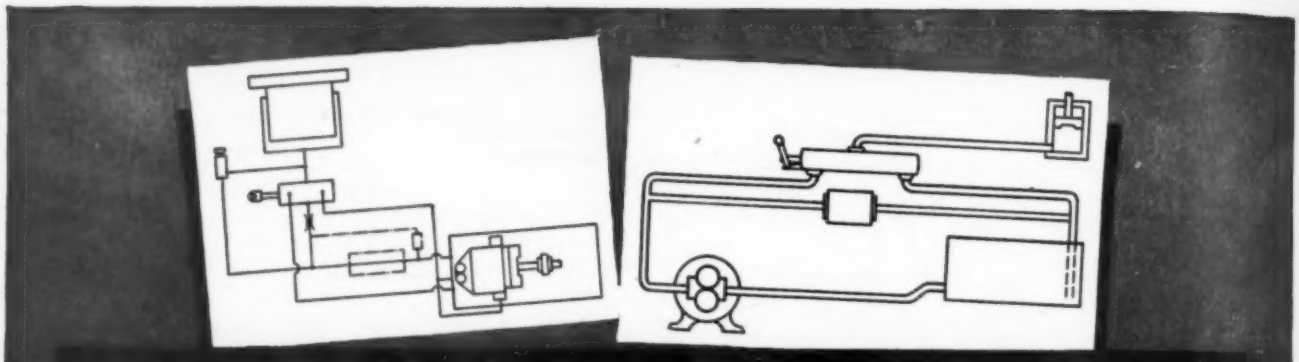
When resistance is developed in the cylinder, after the ram is fully raised, the back pressure closes the pressure switch, energizing the timer. The squeeze function of the timer will energize the airdraulic cylinder solenoid valve, admitting air pressure to the air cylinder side of the booster to bring the electrodes against the work through the hydraulic medium. Current will flow and welding take place until the timer "times out", deenergizing the solenoid valve, and reversing the air flow to cause the guns to retract to "open" position.

Maintaining the welder in operating condition requires normal care of the air line lubricator to provide a light visable mist at the cylinder exhaust while operating. This assures proper lubrication of the cylinder walls and the valves in the circuit. The oil level in the booster must be maintained to assure pressure build-up and any trapped air must be bled from the hydraulic system.



Designed to make six spot welds in an air cleaner baffle and retainer assembly, this welder uses shop air to raise the work to welding position and to power the booster cylinder which brings the electrodes against the work.

Six 1½ in dia cylinders, each moving a welding gun, are powered by oil from the booster. Four inch diameter units were required on full hydraulic designs.



A Beginner's Course in Basic Hydraulics

Chapter VIII

HYDRAULIC PUMPS

Part 4

Screw and Lobe Pumps

Screw and lobe pumps of many designs offer large volume handling ability over a wide range of pressures. Here we describe two designs to show extremes in pressure ratings of gear-like pumps.

IN THIS CHAPTER, WE ARE PRIMARILY CONCERNED with pump designs which develop pressures in excess of 500 psi. This is an arbitrary figure chosen because most industrial and aircraft power applications require pressures in the 500 to 3000 psi range. Pumps generating lower pressures find applications in fluid handling systems where the user is interested more in flow delivery than in force multiplication.

Preceding articles have shown the design differences in materials, bearings and sizes for those spur gear and internal gear pumps used for high pressure and those built for high volume.

Gear-like pumps which include lobe and screw designs are capable of large deliveries in the range of 5000 gpm. They were originally developed for their large handling ability.

Operating on the same principle as gear pumps, oil is trapped between the lobe spaces or screw threads and the housing and carried from suction to discharge. It can be readily seen that flow

---

The February installment stated: "Rotation in the wrong direction of herringbone pumps traps oil in the "V" to produce destructive back pressure strains."

A note from the Worthington Pump and Machinery Corporation points out:

"We have operated our herringbone gear pumps in either direction of rotation with no destructive strains of any kind. In fact, it can safely be said that we have seen no difference in wear, shaft deflection, etc. regardless of whether we run the gears with the apices leading or following. While it may be said that this trapping of oil in the "V" will occur when more than two teeth are in contact at one time, and that shaft deflection might occur if the bearing span is too great, we have experienced no trouble of this sort in our normal applications."

Editor's Note: Strains produced by trapped oil depend on operating pressure range and viscosity of fluid. For pressures over 500 psi and viscosities over 500 SSU, trapping in the "V" will create strains. Worthington applications are at pressures and viscosities below these figures.

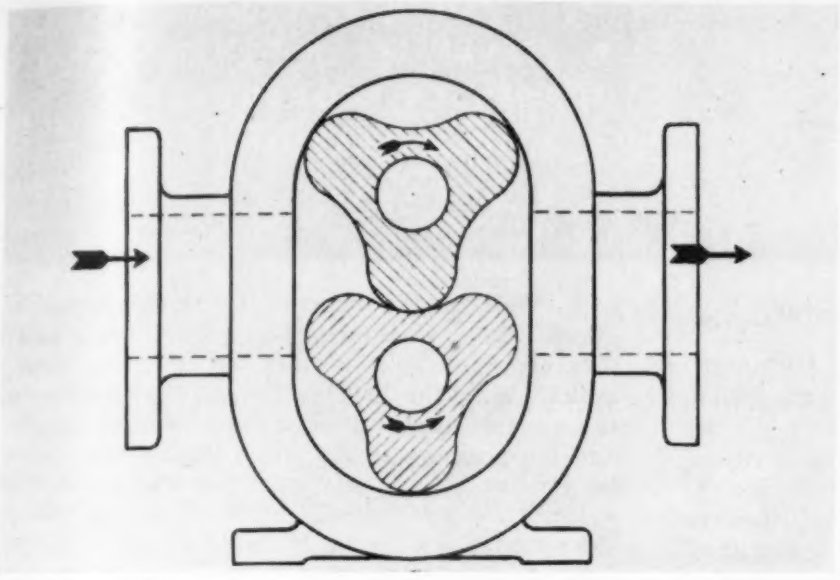


Fig. 9. Large oil deliveries are provided by lobe pumps. Oil from the suction port is trapped between the rotor and outer housing and carried to the discharge port. These are large low pressure units used for fluid handling service.

carrying capacity, or the pump displacement which is a function of tooth space on a gear pump, can be made quite large.

Figure 9 shows a cross-section of a three-lobe pump. One of the rotating members is directly driven by the power source. The other member is driven by timing gears mounted outside the pump chamber. Operating pressures seldom exceed 250 psi. One design of the lobe pump uses a spring loaded vane mounted in each lobe so that the vane assures a sealing point where the crest of each lobe meets the housing. Each lobe is slotted to hold the vane.

While most screw pumps are also high volume, low pressure units, the external screw pump design, as shown in Fgure 10, can be built to develop continuous operating pressures of 1000 psi and intermittent operation to 1500 psi. This pump delivers up to 150 gpm. The high pressure design makes the pump suitable for industrial power applications as well as fluid handling service.

The power rotor, in the pictured DeLaval IMO pump, meshes with two opposed screws. Liquid enters the far end of the pump from the prime mover and leaves at the near end.

To withstand the high pressure, cast steel casings are used and the alloyed steel rotors are hardened and ground. Axial thrust is balanced hydraulically to minimize bearing loads. The rotors mounted in bronze bearing blocks, nest in renewable bronze housings. Two of three stop pins which are clearly shown in Figure 10, insure alignment of the housing bore and the shaft openings in the end bearing block.

Like the other gear pumps that have been described, screw pumps deliver a constant output at a given speed. Where the rotors are properly machined, noise level is low and operation can be almost pulsation free.

Chapter VIII, Part 5 will discuss vane type pumps. Please save each installment for future reference.

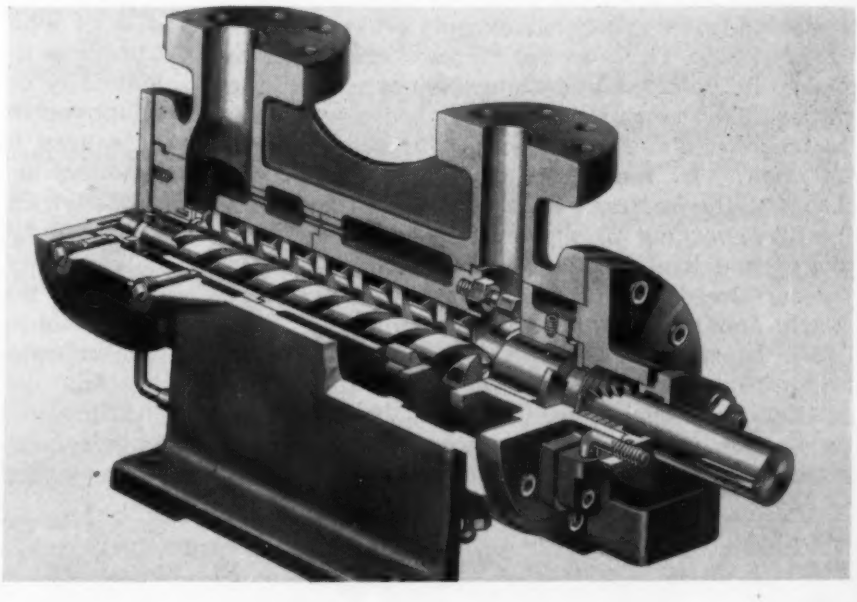


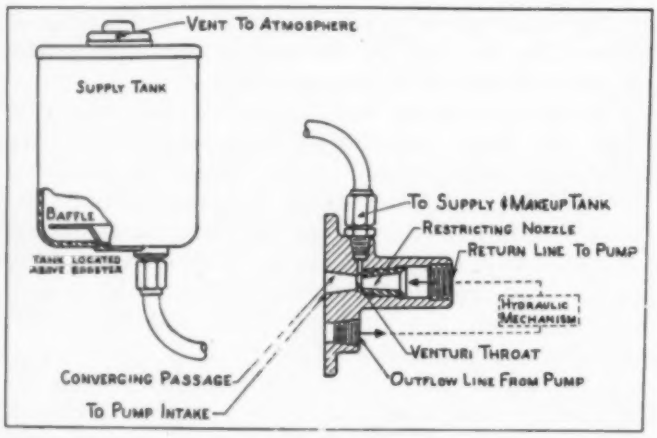
Fig. 10. This DeLaval IMO screw pump will operate at pressures up to 1500 psi making it suitable for industrial power applications. The power rotor drives two meshing screws. Pressure oil balances the thrust loads to minimize wear and insure smooth, quiet operation.

HERE'S HOW

- PREVENTIVE MAINTENANCE
- SERVICE PROCEDURES
- MODERNIZATION
- SHORT CUTS

Comments on Venturi Booster

In the December issue of APPLIED HYDRAULICS, page 30, is an item entitled "Cavitation Effect Minimized With Pump Booster" by F. W. Davis. Mr. Davis should be congratulated on his simple solution to the problem. However, for the benefit of others with similar problems, I believe it advisable to explain how and why it works on his installation and may not work on another pumping system.



Booster Construction

The main feature of his booster is the use of a venturi with the makeup tank connected to the venturi throat. The action of a venturi is fairly well known and simple. With flow through the venturi, the sums of the pressure head and velocity head at each of the three section, entrance, throat and exit are equal except for minor frictional losses. Thus, at the throat there is an increase in velocity and velocity head over the values at the entrance, and there is a corresponding decrease in pressure head (or pressure) at this point. In the diverging passage from the throat to the venturi exit, (the illustration labels this, "converging passage"), this increase in velocity head is almost wholly converted back into pressure head, so that exit pressure and velocity nearly equal the values at the entrance.

The booster works on this type of installation because it is a closed system, in which the oil circulates from the pump, through the hydraulic mechanism and back to the pump without entering a sump or supply tank somewhere in the circuit. Without the booster, the pressure at the pump intake would be atmospheric (plus small pressure due to elevation of the oil in the supply tank). With the booster in use, the pressure at the venturi throat will always be atmospheric, and the pressure at the pump intake will always be greater than atmospheric by the amount of velocity head recovered in the diverging part of the venturi. Thus, the pressure at the pump intake increases with pump speed enough to compensate for the increasing entrance losses between the intake flange and the gears.

Most closed systems have a small makeup pump with relief valve between the supply tank and pump to put the suction side of the system under some definite pressure to eliminate cavitation effects. The booster is similar in effect to such a pump but one that gives increased pressure at high pump speed where it is needed. To be effective the venturi must be designed with the proper throat-exit area ratio to effect a pressure recovery equal to or greater than the intake entrance losses.

In an open system where the pump draws from a supply tank at atmospheric pressure, the booster would tend to increase rather than decrease cavitation because the friction loss, entrance to exit, would be greater than an equal length of pipe. The pressure at the pump intake decreases with pump speed and helps promote cavitation at high speed.

E. T. HANSEN
Racine, Wisconsin

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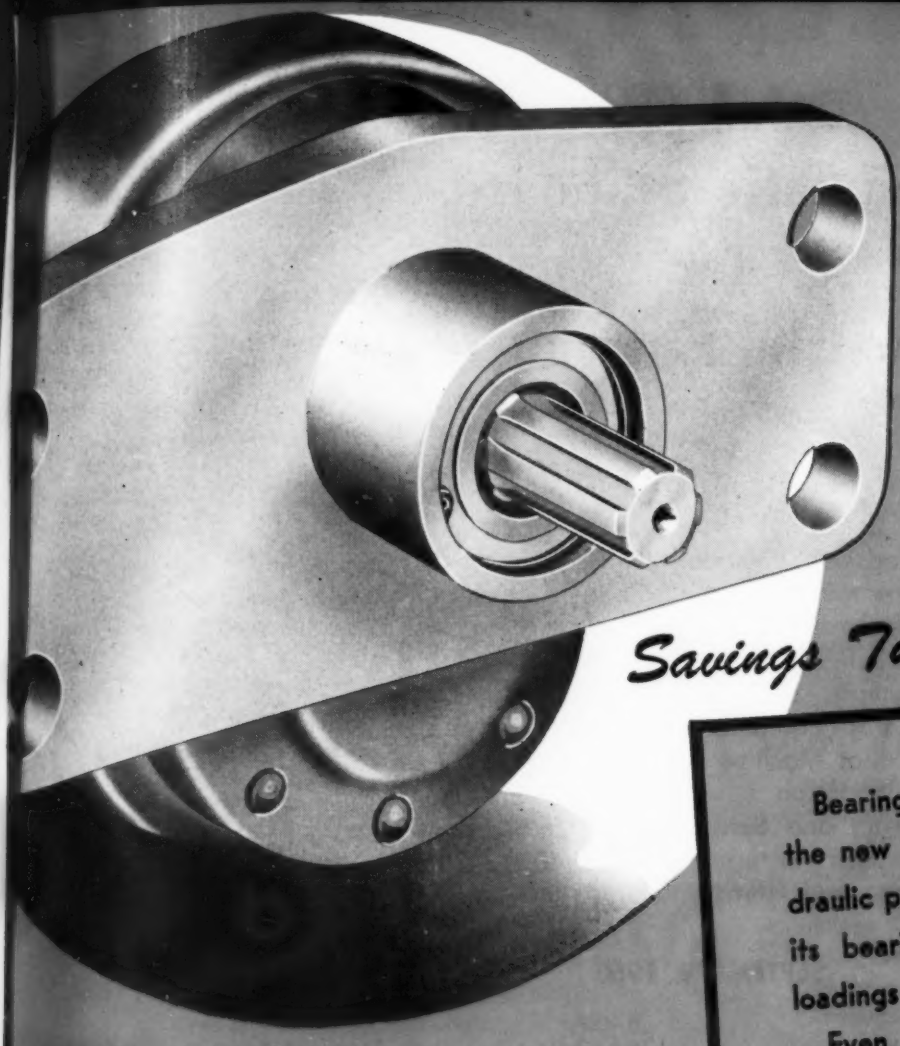

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for
Industrial Equipment

Credit for the formulation of these Standards is due the Joint Industry Conference which includes representatives of the following:

Hydraulic Equipment Manufacturers
Pneumatic Equipment Manufacturers
Industrial Equipment Users
National Machine Tool Builders' Association
Packing and Seal Manufacturers
Press Manufacturers
Tubing and Fitting Manufacturers

SEPTEMBER, 1950

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FOREWORD

The term "Industrial Equipment" referred to in these Pneumatic Standards for Industrial Equipment not only applies to machine tools coming within the following definitions:

(A) "A metal cutting machine tool is a power-driven machine not portable by hand, used for the purpose of removing metal in the form of chips,"

(B) "A metal-forming machine tool is a power-driven machine, not portable by hand, used to press, forge, emboss, hammer, blank or shear metal,"

but also applies to other types of industrial equipment which are not generally classified as "machine tools" but which are air actuated.

NOTES:

The prefix letter "A" is used throughout these Standards to denote its applicability to pneumatic equipment.

Where the letters "J.I.C." are used they refer to Joint Industry Conference.

Proposals for changes in these J. I. C. Standards are considered at meetings of the Joint Industry Conference which are held at intervals for this purpose.

CONTENTS

	Sec. No.	Par. No.
GLOSSARY OF TERMS		
GENERAL	A0	
Purpose of Standards		A0.1
Exceptions to Standards		A0.2
Additional Requirements		A0.3
Engineering Approved Specifications		A0.4
Recommended Use and Installation Requirements		A0.5
Performance Test Requirements		A0.8
Pressure-Time Diagram		A0.9
Quality Standards		A0.10
Accessibility of Equipment		A0.11
DIAGRAMS	A1	
Circuit Diagrams		A1.1
Definition		A1.1.1
Symbolic Diagram Disposition		A1.1.2
Schematic Diagram Disposition		A1.1.3
Diagram Content and Disposition Requirement		A1.1.4
Final Diagram Disposition		A1.1.5

CONTENTS (Cont'd)

	Sec. No.	Par. No.
Standard Symbols		**A1.3**
Legend Code		**A1.4**
Color Code		A1.4.1
Pattern Code		A1.4.2
Definition of Functions		A1.4.3
Diagram Size		**A1.5**
Size Specifications		A1.5.1
PNEUMATIC CONTROLS	**A2**	
Definition		A2.1
Protection		**A2.3**
Over-Pressure Protection		A2.3.1
Pressure Control Construction		A2.3.2
Safety Interlocks		A2.3.3
Protection Against Insufficient Pressure		A2.3.6
Controls—Circuit		**A2.4**
Feed Start Requirements		A2.4.1
Power Conservation		A2.4.2
Solenoid Controlled Valve Failure Protection		A2.4.4
Segregation of Neutral Controls		A2.4.5
Fixed Feed Distance Control		A2.4.6
Position and Safety Stops		A2.4.7
Service Requirements for Equipment Operating at Elevated Temperatures or With Toxic Materials		A2.4.8
Surge Control Requirements		A2.4.9
Positive Control Requirements		A2.4.10
Consistent Feed Rates		A2.4.11
Interlocking of Multiple Units		A2.4.12
Enclosures and Compartments		**A2.5**
Definitions		A2.5.1
Control Protection		A2.5.2
Minimum Compartment Requirements		A2.5.4
Enclosure Door Construction		A2.5.6
Enclosure Accessibility		A2.5.7
Mounting		**A2.6**
Control Protection		A2.6.1
Control Location		A2.6.2
Maintenance Accessibility		A2.6.3
Emergency Stop Control		A2.6.5
Equipment on Piping		A2.6.7
Automatic Control Mounting		A2.6.8
COMPRESSORS	**A3**	
Mounting of Compressors		**A3.3**
Accessibility for Maintenance		A3.3.1
Protection from Damage		A3.3.2
Accessibility within Compartment or Enclosure		A3.3.3
Compressure Compartment Construction		A3.3.4
Compressor Alignment		A3.3.5
Compressor Nameplates		**A3.5**
Nameplate Information		A3.5.1
Duplicate Nameplates		A3.5.2
Rotation Indication		A3.5.3
Valves Required to Permit Pump Removal		A3.5.4
PIPING, FITTINGS AND PASSAGES	**A4**	
Piping Layout		A4.1.1
Piping Strength		A4.1.3
Rigidity of Piping Leads		A4.1.5
Tubing and Fitting Specifications		A4.1.6
Cleanliness and Quality of Workmanship		A4.1.7
Piping Applications		A4.1.8
Construction of High Pressure and Large O.D. Piping		A4.1.9
Flexible Piping Application Requirements		A4.2.4
Maintenance Accessibility		A4.2.6
Shipping Precautions		A4.2.7
Testing Stations		A4.2.8
Piping Identification		**A4.4**
Identification of Piping Runs		A4.4.1
VALVES, ACCESSORIES AND DEVICES	**A6**	
Filters and Lubricators		**A6.1**
Clarification and Filtration Requirements		A6.1.1
Lubrication		A6.1.2
Filter Element Cleaning Requirements		A6.1.4
Intake Cleaners		A6.1.5
Sealing Devices		**A6.2**
Material Specifications		A6.2.1
Leakage Limitations		A6.2.3
Extrusion Prevention		A6.2.4
Stuffing Box Design		A6.2.5
Maintenance Accessibility		A6.2.6
Provision for Standard and Special Packings		A6.2.7
Cylinders and Pistons		**A6.3**
Bore Finish		A6.3.1
Alignment		A6.3.2
Sealing Devices		A6.3.3
Non-Integral Cylinders		A6.3.4
Piston Rod Protection		A6.3.6
Piston and Rod Assemblies		A6.3.7 (A)
Air Vents		A6.3.7 (B)
Cushioning		A6.3.8
Valves		**A6.4**
Locking of Adjustments		A6.4.1
Gasket-Mounted Valves		A6.4.3
Control of Detrimental Surges		A6.4.5
Counterbalance		A6.4.6
Control of Solenoid Hammering		A6.4.7
Storage or Surge Tanks		**A6.5**
Factor of Safety		A6.5.1
Disassembly		A6.5.2
Provision for Air Bleed		A6.5.3
Reference to Safety		A6.5.4
Provision for Automatic Valves and Water Indicators		A6.5.5
Storage or Surge Tank Nameplates		**A6.6**
Nameplate Information		A6.6.1
SAFETY	**A7**	
Flexible Lines		A7.1.1
Manual Control Location		A7.1.2
Accumulators		A7.1.3

ACTUATOR: A device to convert fluid energy into mechanical motion.

AIR: Air as referred to in these Standards means the pressure medium for pneumatic applications.

AUTOMATIC CONTROLS: Those actuated in response to the cycle of the equipment.

BACK CONNECTED: Where piping connections are on normally unexposed surfaces of pneumatic components.

CHANNEL: An air passage the length of which is large with respect to its cross section dimension.

CIRCUIT: An arrangement of component parts or pneumatic equipment interconnected to a specific appliance or appliances.

CLEANER: A device for the removal of solids from a fluid wherein the resistance to motion of such solids is in a straight line.

COMPARTMENT: A space within the base, frame, or column of the equipment.

COMPRESSOR: A device for converting mechanical energy into air energy.

Fixed Displacement: A compressor which delivers a relatively constant volume of air per cycle.

Variable Displacement: A compressor in which the volume per cycle can be varied.

CYLINDER: A linear motion device in which the thrust or force is proportional to the effective cross sectional area and to the pressure differential.

CYLINDER, SINGLE ACTING: A cylinder in which the air pressure can be applied in only one direction.

Plunger Type: A cylinder in which the internal element is of a single diameter, and upon which the seal applied is of the contracting type.

Piston Type: A cylinder in which the internal element is of one or more diameters, and the seal is of the expanding type.

CYLINDERS, DOUBLE ACTING: A cylinder in which air pressure can be applied in either direction.

Single End Rod: A cylinder with a rod extending from one end.

Double End Rod: A cylinder with two rods, one extending from each end.

ENCLOSURE: A housing for pneumatic apparatus.

FILTER: A device for the removal of solids from a pneumatic system wherein the resistance to motion of such solids is in a tortuous path.

FLUID: Any material that will take the shape of the container in which it is placed.

FRONT CONNECTED: Where piping connections are normally on exposed surfaces of pneumatic components.

PNEUMATIC PANEL:

1. **Pneumatic Mounting Panel**
   A plate on which may be mounted a number of pneumatic actuating components.
2. **Pneumatic Control Panel**
   A grouping of pneumatic control units mounted to form one assembly on a plate, or in a casting, and having a single mounting surface.

LINE: A tube, pipe, or hose which acts as a conductor of air.

LINE, EXHAUST: A return line which carries power or control actuating air back to the atmosphere.

LINE, JOINING: A line which crosses or connects with another line on a diagram and which also connects in construction. The junction of the lines shall be indicated by a dot which must be at least three times the width of the line.

LINE, PASSING: A line which crosses another line on a diagram, but which does not connect in construction. Line on a diagram to have no swell at crossing.

LINE, PILOT: A line which acts as a conductor of control actuating air.

LINE, WORKING: A line which acts as a conductor of power actuating air.

LUBRICATOR: A device for adding lubricant to the actuating medium.

MANUAL CONTROLS: Those actuated by the operator, regardless of means.

MASS PRODUCTION: For a model run, or an indefinite period of time.

MOTORS AND CYLINDERS: Devices for converting air energy into mechanical energy.

MOTOR, OSCILLATING: A motor producing a maximum angular rotative movement of less than 360° in either direction.

MOTOR, ROTARY: A motor producing rotary motion having torque output proportional to the displacement per revolution and to the pressure drop between intake and exhausts ports.

MOTOR, ROTARY, FIXED DISPLACEMENT: A rotary motor in which the displacement per revolution is not adjustable.

MOTOR, ROTARY, VARIABLE DISPLACEMENT: A rotary motor in which the displacement per revolution is adjustable.

MUFFLER: A device for reducing exhaust noises.

PASSAGE: A machined or cored connection which lies within or passes through a pneumatic component, and which acts as a conductor of air.

PHASE OF CYCLE:

0. Neutral
1. Rapid advance
2. Feed or pressure stroke (forward and return)
3. Dwell
4. Rapid return

Rapid Advance: The approach of the tools or workpiece to the feed position.

Feed: The portion of the cycle where work is performed on the workpiece.

Dwell: The portion of the cycle where the feed rates or pressure stroke is stopped.

Rapid Return: The return of the tools or workpiece to the cycle starting position.

PORT: An opening at a surface of component; e. g., terminus of a passage. May be internal or external.

PORT, VALVE: A controllable opening between passages; e. g., one which can be closed, opened, or modulated.

POSITIVE POSITION STOP: A structural member which definitely limits the working motion at a desired position.

POSITIVE SAFETY STOP: A fixed structural member which confines maximum travel within the design limits of the machine or equipment.

PRESSURE-TIME DIAGRAM: A graphical presentation of pressure in pounds per square inch plotted against time for a complete cycle of the equipment.

RESTRICTION: A device which produces a deliberate pressure drop or resistance in a line or passage by means of a reduced cross-sectional area.

Choke: A restriction, the length of which is relatively large with respect to its cross-section dimensions.

Orifice: A restriction, the length of which is relatively small with respect to its cross-section dimensions.

SCHEMATIC DIAGRAM: A drawing or drawings showing the functional construction of all valves, controls, and actuating mechanisms.

SEALING DEVICE: A part or assembly of parts used to prevent leakage between two or more other parts.

SEPARATOR: A device to separate water or other materials of different specific gravities from the actuating medium.

SUB-PLATE (Back Plate): An auxiliary mounting for a pneumatic actuating component to which piping connections are mounted.

SURGE: A transient rise of air pressure in the circuit.

SYMBOLIC DIAGRAM: A drawing or drawings showing by means of approved standard symbols each and every piece of pneumatic apparatus including all inter-connecting lines.

TRIP DEVICE: A mechanical element for the actuation of a position control.

UNIT PRODUCTION: One piece per set-up.

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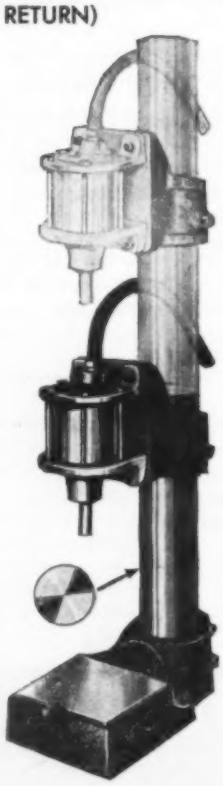

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A0 GENERAL

A0.1 (A) The purpose of these Standards is to provide specifications for the application of pneumatics to industrial equipment which will promote safety of personnel, uninterrupted production, long life of the machine, equipment or tool, and will not limit or inhibit advancement in the art of pneumatics.

(B) Where new developments in pneumatics will perform in a manner equal to these specifications they will be considered as equivalent.

A0.2 These Standards are proposed to cover pneumatic equipment in general applications. Any exceptions to these Standards will be as agreed upon between supplier and purchaser.

A0.3 The purchaser shall specify such additional details as are needed to meet unusual operating conditions.

A0.4 (A) The builder shall submit necessary performance specifications on pneumatic equipment, including symbolic or schematic diagrams in accordance with Paragraph A1.1.4 (A) for purchaser's approval. Final diagrams and text shall conform to the pneumatic equipment shipped.

(B) Part numbers shall be provided for all types of pneumatic equipment. Seal manufacturers' catalog number shall also be provided where sealing devices are commercially available.

A0.5 All pneumatic equipment shall be installed and used in accordance with the recommendations of the manufacturers thereof.

A0.8 All industrial equipment at the completion of assembly and before shipment shall be given complete performance tests to determine conformity with equipment specifications. There shall be no evidence of external leakage.

A0.9 A pressure-time diagram taken under operating conditions including data concerning maximum rate of pressure rise shall be furnished when specified on purchase order.

A0.10 Pneumatic equipment shall be of proven engineering design, fabricated of material of accepted quality and with workmanlike finish; and must be capable of performing efficient, reliable service in the installation for which it is provided.

A0.11 Pneumatic equipment and piping shall be accessible and mounted in a position that will not interfere with machine adjustments or maintenance of electrical, hydraulic, or mechanical equipment. (See A2.6.3; A4.2.6 and A6.3.4).

A1 DIAGRAMS

A1.1—Circuit Diagrams

A1.1.1 (A) **Symbolic Diagram** — A drawing or drawings showing by means of approved standard symbols each and every piece of pneumatic apparatus, including all inter-connecting lines.

(B) **Schematic Diagram**—A drawing or drawings showing the functional construction of all valves, controls, and actuating mechanisms including all interconnecting lines.

A1.1.2 Symbolic Diagrams

(A) Symbolic diagrams shall be furnished with industrial equipment. (Schematic diagram acceptable.)

(B) A copy of the diagram shall be firmly attached to the inside cover of the

pneumatic control enclosure or pneumatic diagram enclosure, either by adhesive material or by permanent data pocket or clip.

A1.1.3 Schematic Diagrams

(A) When requested on purchase order, a schematic diagram shall be supplied.

(B) When requested on purchase order, a schematic diagram shall show and describe the flow paths for each phase of each complete cycle.

(C) When requested on purchase order, a schematic diagram shall show in color only those portions of the circuit which are functioning at each single phase of the cycle. (See A1.4)

A1.1.4 All Diagrams

(A) The descriptive text shall explain the function of all components of the circuit and the sequence of the operations. Either the diagram or descriptive text shall include, in addition to the sequence of operations, the following when applicable:

1. All pneumatic equipment shall be identified. When possible, catalog number and manufacturer's name shall be shown.
2. Size of piping.
3. Diameters of pistons and rods, length of stroke, and estimated required force of cylinders when other than maximum pressure is applied.
4. Time of cycle, when pertinent. (For example: time range of cycle exclusive of loading).
5. Operating pressures.
6. Horsepower and R. P. M. of each pneumatic drive.
7. Delivery and consumption in cubic feet of free air per minute.
8. Storage or surge tank capacity in cubic feet.
9. Displacement, speed range, and torque rating of each pneumatic motor.
10. Data or text, or both, shall show operations performed and characteristics of any actuating electrical equipment used.

(B) The related text and the diagram shall be shown on the same or facing pages.

(C) All diagrams shall be marked with serial number or with the purchaser's order number of that equipment, or, if none, with some other symbol which will identify the particular apparatus to which the diagram applies.

A1.1.5 Requested number of copies of final diagrams and texts shall be forwarded by mail or in person to an individual delegated by the purchaser not not later than the date on which the shipment is made.

A1.3—Standard Symbols

Introduction

(A) Standard symbols shall be used for symbolic diagrams and for showing flow paths in schematic diagrams.

(B) **Directional Control Valves:** The flow condition which is shown closest to the operating device is that which exists when the device is operated.

(C) The Standard Symbols and sample drawing of a Pneumatic Circuit utilizing the Standard Symbols to indicate the nature and function of component parts in the circuit are shown on the following pages.

AVICA

Specialists in Flexible Pipes

SYNTHETIC HOSE • METALLIC HOSE

FOR ALL FLUID SYSTEMS THROUGHOUT A WIDE TEMPERATURE RANGE

● **Avica Synthetic Rubber and flexible metal hose with integral angle couplings.**

● **Avica Swivel Flange couplings for aluminum and stainless steel tubing.**

● **Avica Fire Resistant support clamps for flexible and rigid pipes and electric cables.**

● **Avica Special Design assemblies to solve awkward installation problems.**

THERE IS AN AVICA HOSE ASSEMBLY FOR EVERY AVIATION APPLICATION.

SEND US BLUE PRINTS OR SKETCHES AND OUR ENGINEERING DEPARTMENT WILL DESIGN A HOSE ASSEMBLY TO FIT YOUR REQUIREMENT.

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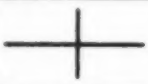
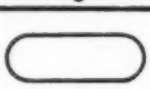
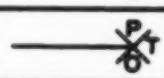
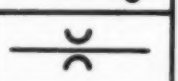
IN EUROPE
AVICA EQUIPMENT, Ltd.
50 PALL MALL
LONDON, S.W.1, ENGLAND

TRADE MARK

Circle 59 on Reader Service Card

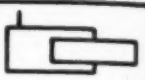
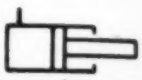
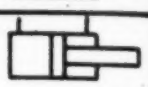
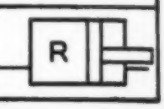
A1.3 STANDARD SYMBOLS SHALL BE IN ACCORDANCE WITH THE FOLLOWING RECOMMENDATIONS:

(BASIC SYMBOLS CAN BE COMBINED IN ANY FORM DESIRED. NO ATTEMPT IS MADE TO SHOW ALL COMBINATIONS.)

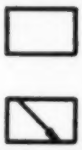
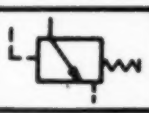
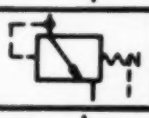
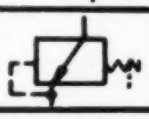
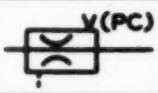
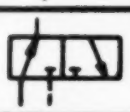
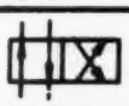
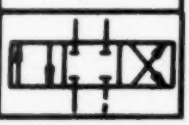
LINES	
LINE, WORKING	
LINE, PILOT	
EXHAUST	
LINE, FLEXIBLE	
CONNECTOR (DOT TO BE 3 × WIDTH OF ASSOCIATED LINE)	
DIRECTION OF FLOW	
LINE, PASSING	
LINE, JOINING (TEE CROSS ETC.) (DOT TO BE 3 × W)	
STORAGE OR SURGE TANK	
PLUG OR PLUGGED CONNECTION	X
TESTING STATION (GAGE CONNECTION)	
POWER TAKE-OFF	
RESTRICTION, FIXED	

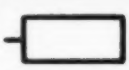
COMPRESSORS	
COMPRESSOR, SINGLE FIXED DISPLACEMENT	
COMPRESSOR, SINGLE VARIABLE DISPLACEMENT	

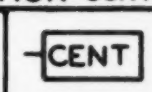
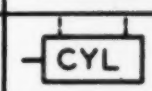
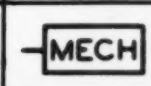
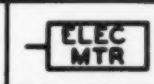
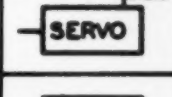
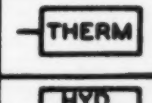
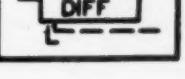
MOTORS AND CYLINDERS	
MOTOR, ROTARY FIXED DISPLACEMENT	

MOTORS AND CYLINDERS-CONT'D	
MOTOR, ROTARY VARIABLE DISPLACEMENT	
MOTOR, OSCILLATING	
CYLINDER, SINGLE ACTING PLUNGER TYPE	
PISTON TYPE	
CYLINDER, DOUBLE ACTING SINGLE END ROD	
DOUBLE END ROD	
CYLINDER, ROTATING, AIR	

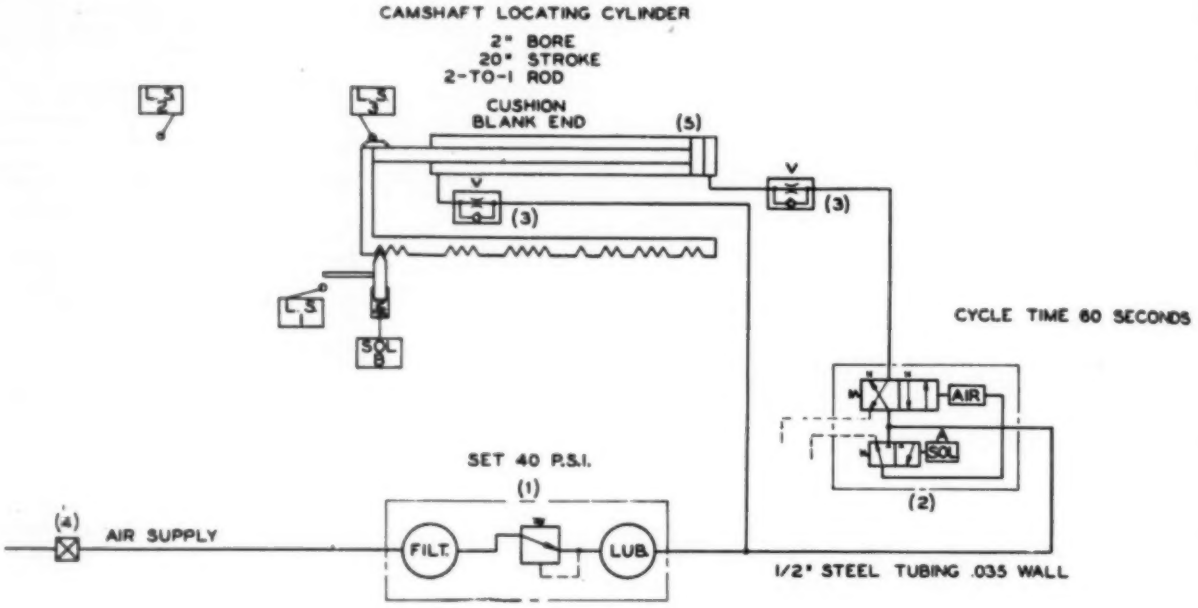
MISCELLANEOUS UNITS	
MOTOR, DRIVE, ELECTRIC	
LUBRICATOR	
INTENSIFIER	
ACCUMULATOR	
FILTER	
SEPARATOR	
PRESSURE SWITCH	
PRESSURE GAGE	
SPRING	
SHAFT, ROTATING	
COMPONENT ENCLOSURE	

VALVE	
VALVE, CHECK	
VALVE, RESTRICTION, VARIABLE	
VALVE, BASIC SYMBOL (INSERT MODEL NO. FOR SPECIAL VALVES) METHOD OF INDICATING INTERNAL FLOW	
VALVE EXAMPLES	
VALVE, MANUAL SHUT OFF	
VALVE, MAXIMUM PRESSURE	
VALVE, RELIEF REMOTELY OPERATED	
VALVE, SEQUENCE DIRECTLY OPERATED	
VALVE, PRESSURE REGULATOR	
VALVE, FLOW CONTROL PRESSURE COMPENSATED	
VALVE, SHUT OFF 2 POSITION-2 CONNECTION	
VALVE, DIRECTIONAL 2 POSITION-3 CONNECTION	
VALVE, DIRECTIONAL 2 POSITION-4 CONNECTION	
VALVE, DIRECTIONAL 3 POSITION-4 CONNECTION CLOSED CENTER	

METHODS OF OPERATION	
CONTROL, BASIC SYMBOL	

METHODS OF OPERATION-CONT'D	
CONTROL, CENTRIFUGAL	
CONTROL, COMPENSATOR	
CONTROL, COMPENSATOR PRESSURE	
CONTROL, COMPENSATOR TEMPERATURE	
CONTROL, CYLINDER	
CONTROL, DETENT	
CONTROL, MANUAL	
CONTROL, MECHANICAL	
CONTROL, MOTOR ELECTRIC	
CONTROL, MOTOR AIR	
CONTROL, PILOT HYDRAULIC	
CONTROL, PILOT AIR	
CONTROL, SERVO	
CONTROL, SOLENOID	
CONTROL, SOLENOID HYD. PILOT OPERATED	
CONTROL, SOLENOID AIR PILOT OPERATED	
CONTROL, THERMAL	
CONTROL, PILOT HYD. DIFFERENTIAL AREA	

SAMPLE PNEUMATIC CIRCUIT



SEQUENCE OF OPERATION

(1) OPERATOR LOADS AND CLAMPS PART MANUALLY AND PUSHES CYCLE START BUTTONS
(2) SOLENOIDS "A" AND "B" ARE ENERGIZED AND WHEN L.S.-1 IS TRIPPED SOLENOID "B" IS DE-ENERGIZED
(3) CYLINDER MOVES FORWARD UNTIL WEDGE ENCOUNTERS NEXT NOTCH IN RACK
(4) CYLINDER DWELLS AT THIS POINT UNTIL ELECTRIC TIMER TIMES OUT AND SOLENOID "B" IS AGAIN ENERGIZED AND FIXTURE MOVES TO NEXT NOTCH IN RACK
(5) THIS CYCLE IS REPEATED UNTIL L.S.-2 IS TRIPPED
(6) L.S.-2 ENERGIZES TIMER #2, WHEN TIMER #2 TIMES OUT SOLENOID "A" IS DE-ENERGIZED AND SOLENOID "B" IS ENERGIZED AND CYLINDER RETURNS TRIPPING L.S.-3 DE-ENERGIZING SOLINOID "B" COMPLETING CYCLE.

A1.4 Legend Code

A1.4.1 Color Code

Function	*Color*
Intensified Pressure	Black
Supply Pressure	Red
Charging Pressure) Reduced Pressure)	Intermittent Red
Metered Flow	Yellow
Exhaust	Blue
Intake	Green
Inactive	Blank

A1.4.2 Pattern Code

Function	*Pattern No.*	*Suggested Zip-A-Tone or Equivalent Pattern*
Intensified Pressure	#7R	
Supply Pressure	#177	
Charging Pressure) Reduced Pressure)	#52-0	
Metered Flow	#63	
Exhaust	#75	
Intake	#16	
Inactive	Blank	

A1.4.3 Definition of Functions

Function	*Definition*
Intensified Pressure	Pressure in excess of supply pressure and which is increased by a booster or intensifier.
Supply Pressure	Power actuating air.
Charging Pressure	Compressor — Inlet pressure that is higher than atmospheric pressure.
Reduced Pressure	Auxiliary pressure which is lower than supply pressure.
Metered flow	Controlled Flow Rate
Exhaust	Return of power actuating medium to atmosphere.
Intake	Sub-atmospheric pressure, usually on intake side of compressor.
Inactive	Air pressure which is within the circuit but which does not serve a functional purpose during the phase being represented.

A1.5 Diagram Size

A1.5.1 All Diagrams shall be of such size as to clearly disclose all components of the systems. Diagrams shall be 8-½"x11" or folded to that size.

BECKETT Hi-Cyclic VALVES

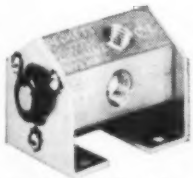
PROVIDE COMPLETE CONTROL OF AIR AND HYDRAULIC CYLINDER ACTION!

88 MODELS — 1/8" to 1" — *SOLVE EVERY CONTROL PROBLEM*

ENTIRELY new, Hi-Cyclic Valves are opening up unlimited applications for accurate, fast, smooth control of air-powered and hydraulically operated labor-saving machinery.

AIR VALVES

3 or 4-Way RECIPROCATING VALVES



Model B

High performance valve capable of 2500 cycles per min. Unlimited applications. Selective directional speed control obtained by adjusting piston stop nuts. Available in 1/8", 1/4", 3/8" and 1/2" ports and with spring load for cam operation or motor control.

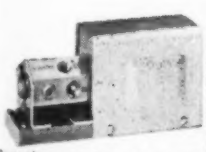
Model BB

Same as Model B Valve with spring load and special ball point designed for cam operation. Has special mounting bracket for mounting in four different positions. Selective speed control obtained by adjusting piston stop nuts. Available in 1/8" and 1/4" ports. Model BB 3/8" and 1/2" Valve same as 1/8" and 1/4" Model BB except mounting bracket is not supplied. This valve is mounted same as Model B 3/8" Valve.

Model BBFT Same as Model BB Valve except equipped with fingertip control for hand operation. Operates with very light fingertip pressure. Available in 1/8" and 1/4" ports with special mounting bracket for mounting in four different positions. Model BBFT 3/8" and 1/2" Valve same as 1/8" and 1/4" Model BBFT Valves except mounting bracket is not supplied.

SOLENOID AIR VALVES

3 or 4-Way



Model B-1

Single solenoid valve with spring return. Directional speed control obtained by adjusting piston stop nuts. Operates on any air pressure, without lag time, as fast as is electrically possible with an A.C. solenoid. Suitable for all conventional valve operations and fast cycle operations. Available in 1/8", 1/4", 3/8" ports.

SOLENOID AIR VALVES

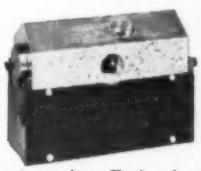
Model B-2

Double solenoid, momentary contact controlled valve. Operates on momentary electrical impulse, making possible any desired action without complex wiring, relays or timers. Will control air cylinder stroke within 0.001". Available in 1/4", 1/4", 3/8" ports.

5 Port • Dual Exhaust Valves

Hi-Cyclic Valves Model B, B-Spring Loaded, BB, BBFT, B-1 and B-2 are available in 1/8", 1/4", 3/8" ports with pinned stop nuts and exhaust controls for selective direction speed adjustment.

PILOTED MODEL AIR VALVES



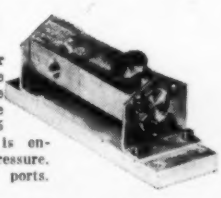
Model B-1

Heavy-duty piloted, single solenoid controlled valve. Available in 1/2", 3/4", 1" ports. Same high performance as smaller valves. Operates with instantaneous full port opening. Equipped with dual exhaust ports for directional speed control.

Piloted Model B-2 Heavy-duty, air-piloted double solenoid valve with momentary contact control. Available in 1/2", 3/4", 1" ports. Instantaneous full port opening on operation. Same exacting performance as Model B-2 valve. Equipped with dual exhaust ports for directional speed control.

AIR TIME DELAY VALVE

Model ATD

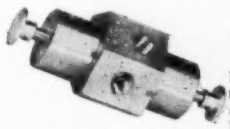


For operating air cylinders with a time delay on return stroke, accurately adjustable from 5 seconds to 5 minutes. Operation is entirely by air pressure. Available with 1/4" ports.

4-WAY HYDRAULIC VALVES

Hi-Cyclic Valve Models B, B-Spring Loaded, BB, BBFT, B-1 and B-2 are available in 1/4" and 3/8" ports for oil and water applications up to 750 p.s.i. Same fundamental construction and performance as Hi-Cyclic Air Valves.

MASTER PILOTED VALVES



Model M-1

Hand-controlled or remote piloted by any 1/8" or 1/4" Beckett Hi-Cyclic Air Valve. Exacting performance with or without use of electrical control. Supplied with 3/8" ports. May be operated either with air or oil.

Model M-2

Extremely accurate valve for remote piloting of large cylinders by any mechanically or electrically controlled 1/8" or 1/4" Hi-Cyclic Valve, as well as by Model ATD Valve to make a time delay possible on large cylinders. Model M-2 valve has 1" ports which can be bushed down for smaller connections. Valve can operate on air and be piloted by air; operate on oil and be piloted by air; operate on oil and be piloted by oil. When operated by oil and piloted by air, valve functions with greater accuracy than is possible to obtain with a solenoid-operated valve. For applications up to 1500 p.s.i.

Model M-3 Master-piloted valve with 1/4" ports. Can be piloted by any 1/8" or 1/4" Hi-Cyclic Valve. For reciprocating actions where extremely slow travel is required without electrical control. Operated and piloted by air or oil, as Model M-2 Valve. For straight air operations, M-3 Valve is a 5-port valve with dual exhausts for directional speed control. For oil operations, valve is 4-port with single exhaust port. No directional control with oil. Applications up to 1500 p.s.i. Extremely accurate when operated on oil and piloted by air. Will not stop on dead center regardless of how slow valve is operated.

Model M-4 Master-piloted valve with 3/8" ports. Can be piloted with any 1/8" or 1/4" Hi-Cyclic Valve. Same action and operation as M-3 Valve.

• • • • • •

Engineering drawings and complete data available on all Hi-Cyclic Valve Models. Write for details outlining your requirements. Also manufacturers of automatic air-powered tapping controls and drill press feeds; especially designed "packaged air controls" for converting machine tools and production machinery into automatic, precision, time-saving units. Recommendations for any air or hydraulic control problem submitted without obligation.

BECKETT-HARCUM COMPANY

1145 WAYNE ROAD • WILMINGTON, OHIO

Circle 21 on Reader Service Card

A2 PNEUMATIC CONTROLS

A2.1—Definition of Controls

(A) Manual controls are those actuated by the operator, regardless of means.

(B) Automatic controls are those actuated in response to the cycle of the equipment.

A2.3—Protection

A2.3.1 Over-pressure and under-pressure regulation shall be provided on pneumatic circuits where required. The adjustments on the pressure control units shall be accessible. Provision shall be made to permit locking enclosure or compartment in which pressure control unit is mounted, or protective locking type adjustments shall be provided to prevent tampering.

A2.3.2 All pressure controls shall be so constructed as not to be adjustable outside nominal working ranges, and shall be marked to indicate nominal minimum and maximum pressures.

A2.3.3 Where there is more than one source of supply on the equipment and possible damage may be caused by the stoppage of any of any one source, interlocks shall be provided so that the stoppage of one source in the circuit will not endanger or damage the equipment.

A2.3.6 Where loss of supply pressure may result in damage to equipment, loss of accuracy, or danger of injury to personnel, means shall be provided to prevent operation under those conditions.

A2.4—Controls—Circuit

A2.4.1 When shifting from rapid traverse to feed, the starting position of the feed rate shall be maintained consistent with the type of service required.

A2.4.2 Pneumatic circuits shall be so designed as to minimize air consumption, the generation of heat and to conserve power.

A2.4.4 In each electrically controlled circuit, in case of solenoid failure, means shall be provided to prevent damage to equipment, loss of accuracy, and danger of injury to personnel.

A2.4.5 Neutral valve positioning controls shall be independent of and unaffected by adjustment of other controls.

*A2.4.6 Where practicable, feed and cycle limiting trip devices on mass production equipment shall be so arranged that the feed distance can be set and sealed. After feed distance is pre-set the control mechanism shall be adjustable as a unit.
*(See Engineering Developments, end of Standards.)

A2.4.7 (A) **Positive position stops** shall be so designed that the dwell time will not be affected when positive position stops are reset.

(B) **Positive safety stops** for machine slides shall not be adjustable, but shall have provision for replacement.

A2.4.8 On industrial equipment operated at elevated temperatures or with toxic materials, the circuits shall be so designed and located that they can be serviced while equipment is operating under these conditions.

A2.4.9 Pneumatic circuits shall be so designed, constructed and applied that unnecessary surge pressures are minimized at their source, and equipment shall be of adequate strength to withstand all operating pressures and surge pressures.

A2.4.10 Pneumatic circuits shall be so designed as to prevent uncontrolled movement of the equipment-operating devices in all phases of the equipment cycle including the idling phase.

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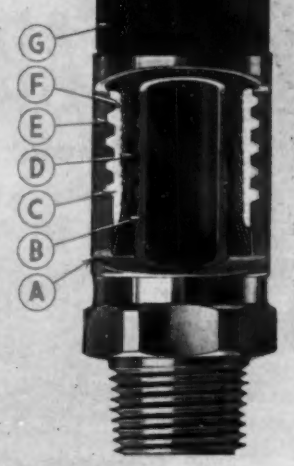

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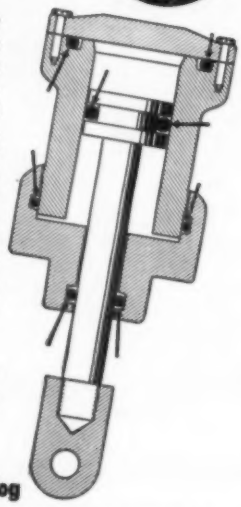

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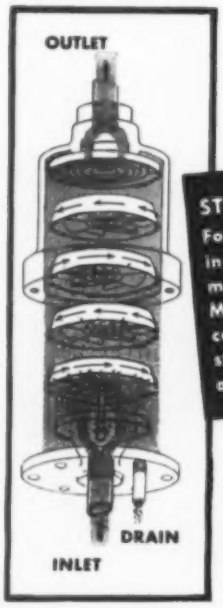

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A2.4.11 Pneumatic circuits shall be so designed, and when necessary incorporate suitable dashpot devices, as to adequately compensate for load variations and their effect on the compressible actuating medium in relation to the intended service.

A2.4.12 Circuits having two or more heads, slides or actuators shall be provided with means to insure all units operating in proper relation regardless of load variation.

A2.5—Enclosures and Compartments

A2.5.1 For the purpose of these Standards, an enclosure means a housing for pneumatic apparatus. A compartment means a space within the base, frame, or column of the equipment.

A2.5.2 Automatic controls that might be damaged by exposure to dirt or dust or stock moving equipment shall be adequately protected and readily accessible.

A2.5.4 Doors and other parts of compartments for automatic controls shall be sheet steel not less than 14 USS gage, or cast metal not less than ¼" thick. Compartments for automatic controls shall be completely isolated from coolant, cutting or lubricating oil, chips and dirt.

A2.5.6 (A) When enclosures for control devices are required they shall have hinged covers which swing horizontally and shall be held closed with screws which require the use of a tool (wrench or screw driver) to remove.

(B) Means shall be provided for locking when requested by purchaser.

A2.5.7 The arrangement of enclosures for mounting controls shall permit ample room for proper maintenance.

A2.6—Mounting

A2.6.1 (A) **All Controls:** All controls shall be mounted so as to minimize the possibility of damage from floor trucks or other stock moving equipment. They shall be protected against falling objects and operator's accidental movements. No controls shall be placed in in high heat areas or in locations subject to any harmful conditions unless properly protected.

(B) **Manual Controls:** All manual controls shall be mounted within reach of the operator when in his normal operating position. Operator shall not be required to reach past revolving spindles or moving tools to reach manual controls. (See Paragraph A7.1.2)

(C) **Automatic Controls:** Automatic controls shall be so located and protected as to prevent inadvertent operation.

A2.6.2 All pneumatic controls shall be mounted two feet or more above the bottom of the equipment providing such mounting will not impair the proper functioning of the circuit. (This paragraph is written as a guide for all new machinery and equipment with the understanding that any deviation will be in accordance with paragraph A0.2).

A2.6.3 Pneumatic control units shall be mounted in positions which provide complete accessibility to all units for maintenance without interfering with adjacent equipment.

A2.6.5 All industrial equipment shall incorporate an emergency stop control readily accessible from operator's normal position.

A2.6.7 Piping shall not be used as a means for supporting valves or equipment where vibration may prove detrimental to piping.

A2.6.8 Automatic controls shall be mounted as close to actuator as practicable to keep working lines as short as possible to prevent waste of air and excessive actuating time lag. Mounting should be such that adherence to the above does not violate Paragraph A2.6.3.

Circle 63 on Reader Service Card

A3 COMPRESSORS

A3.3—Mounting Compressors

A3.3.1 Compressors or subassemblies including the compressors, shall be readily accessible for maintenance.

A3.3.2 Compressors shall be mounted where they are adequately protected from damage.

A3.3.3 When compressors and other apparatus are mounted inside a compartment or enclosure, sufficient space must be provided to assure complete accessibility to all units.

A3.3.4 Compressor compartments must be clean, free of moisture and adequately vented. All openings must be of sufficient height above the floor or be protected to such an extent that dirt, chips, coolant, etc., cannot enter, especially at such times as floor is swept or washed.

A3.3.5 Direct-coupled compressors must be properly aligned and securely mounted in such a manner as to assure alignment under normal operating conditions. When mounted inside column or base of equipment, foot-mounted compressors and driving motors shall be mounted on a sub-base of adequate strength which can be easily removed for servicing. The coupling must have adequate capacity to transmit the power required.

A3.5—Compressor Nameplates

A3.5.1 The following information shall be permanently indicated on each compressor:

(A) Manufacturer's name and address.

(B) Manufacturer's identifying part number.

(C) Manufacturer's serial number if any.

A data sheet or catalog providing complete information on speed limits, pressure range, delivery and horsepower required shall be provided with the specifications.

A3.5.2 Whenever a compressor is mounted so that its nameplate is not readily visible, a plate with duplicate information shall be provided where it can be readily seen. Such duplicate plate shall be marked "duplicate". The nameplate shall not be removed from the compressor.

A3.5.3 The direction of rotation of each compressor shall be clearly indicated on the compressor where it can be readily seen.

A3.5.4 All necessary valves for removal of any compressor while other compressors are still in operation shall be provided.

A4 Piping, Fittings, and Passages

(Piping includes all pipe, tubing, hose and fittings. Passages include all air conductors other than piping.)

A4.1.1 When requested on purchase order, a piping layout or photograph shall be furnished.

A4.1.3 Piping shall have adequate strength to withstand additional pressure, including surge pressure, within the safety limits of the entire circuit. A factor of safety of at least eight (8) over normal working pressure is recommended except for flexible hose. (See paragraph A4.2.4.)

A4.1.5 Piping leads in working circuits between actuating devices and feed control devices shall be so constructed as to rigidly confine a minimum volume of air, the purpose being to maintain constant, controlled motion and minimize the effect of varying forces.

A4.1.6 (A) Solderless pipe connections shall be used (for example: flared, flareless, self-flaring, flanged, or equivalent).

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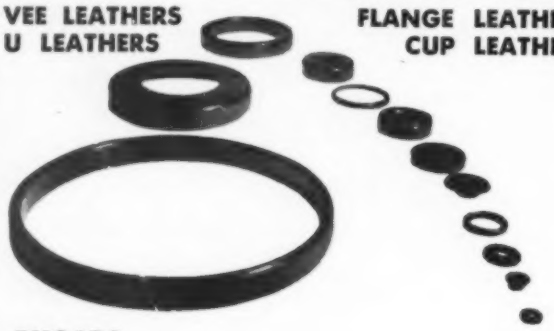

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(B) When flared type fittings are used (which require a flaring tool), the angle of flare of tubing shall be 37° from the centerline, 74° included angle, and flare dimensions shall be in accord with Army-Navy Design 10061.

*(C) All pipe threads shall be Dryseal American (National) Standard Taper Pipe Threads (N.P.T.F.).

(D) Fittings with straight threads and which incorporate seals that seal with pressure may be used in place of pipe thread fittings.

(E) All piping connections shall be so designed and installed as to permit quick removal and re-assembly by means of hand tools.

(F) Tubing outside diameter sizes shall increase in 1/16" increments from ⅛" to and including ⅜" and in increments of ⅛" above ⅜" diameter up to and including 1" diameter and in ¼" increments above 1" diameter.

(G) Fittings with restricted or stepped-up passages are not recommended.

*(See Engineering Developments, end of Standards.

A4.1.7 All piping, piping fittings, passages, storage or surge tanks, cored holes or drilled holes must be free of burrs, or foreign matter which might cause damage to any pneumatic unit. Sharp edges shall be removed whenever they adversely affect the flow of air.

A4.1.8 Whenever practicable, each piping run must be integral and continuous from one piece of apparatus to another. Piping runs must be removable without dismantling equipment components and without bending tubing or springing it in a manner to damage it. All rigid piping must be securely supported at frequent intervals to avoid vibration or movement. Points of contact or support on the outside of the piping shall be so designed that they will not result in damage to the piping. Piping shall not be welded to supports.

A4.1.9 When high or extra high pressure piping is used all connections shall be welded to steel flanges; or connection may be used which are equal in performance and ease of assembly. Flanged connections shall use sealing devices that seal with pressure (all welded joints shall be stress relieved).

A4.2.4 All portions of piping circuits subject to movements in which flexible hose is required, oil-resistant hose shall be used and shall be fabricated to a pressure safety factor of at least five (5) with respect to the circuit in which it is used. Flexible hose shall have vertical connections and shall have sufficient slack to avoid sharp flexing and straining. Horizontal connections are acceptable only if hose is adequately supported.

A4.2.6 Piping shall not be placed where it will interfere with the adjustment, repair or replacement of control units, and piping connections shall be readily accessible for maintenance.

A4.2.7 When construction of equipment necessitates shipment or moving in sections, thorough precautions shall be taken to adequately protect piping runs, whether they be left in place on one of the equipment sections or whether they are removed and separately boxed for shipment. All male threads shall be sleeved, and all piping openings or female threads equipped with suitable closures.

A4.2.8 Piping shall be so arranged that pressures may be tested at accessible locations, preferably at built-in checking stations which shall be indicated on diagrams.

Circle 66 on Reader Service Card

A4.4—Identification of Piping and Checking Stations

A4.4.1 Piping runs and checking stations shall be permanently identified to correspond with diagram markings.

A6 VALVES, ACCESSORIES, AND DEVICES

A6.1—Filters and Lubricators

A6.1.1 Means shall be provided for the removal of deleterious materials from the pneumatic system which would be detrimental to the operation of the equipment.

A6.1.2 Suitable means of air line lubrication shall be provided when practicable.

A6.1.4 Filters shall be of such construction that the filter medium can be removed for cleaning or replacement without disturbing the piping. When practicable, suitable means shall be provided to indicate when filter should be cleaned.

A6.1.5 Intake cleaners shall be provided and shall be of ample size to clean more than double the capacity. Suitable means shall be provided to remove cleaners.

A6.2—Sealing Devices

A6.2.1 All sealing devices must be of such materials that they will not be adversely affected by air or lubricants.

A6.2.3 Sealing devices on reciprocating or rotating shafts shall prevent leakage, except that required for lubrication of such devices under working conditions without damaging shafts.

A6.2.4 Clearances in sealing glands shall be such as to prevent undue extrusion of the sealing material.

A6.2.5 Stuffing boxes for automatic packing shall be so designed as to prevent adjustment beyond the functional limits of the packing.

5 BODY STYLES + SPRING RETURN or NO SPRING RETURN + 5 PIPE SIZES
+ 10 CONTROL ASSEMBLIES + NUMEROUS VARIATIONS
= Thousands Upon Thousands of VALVAIR AIR CONTROL COMBINATIONS

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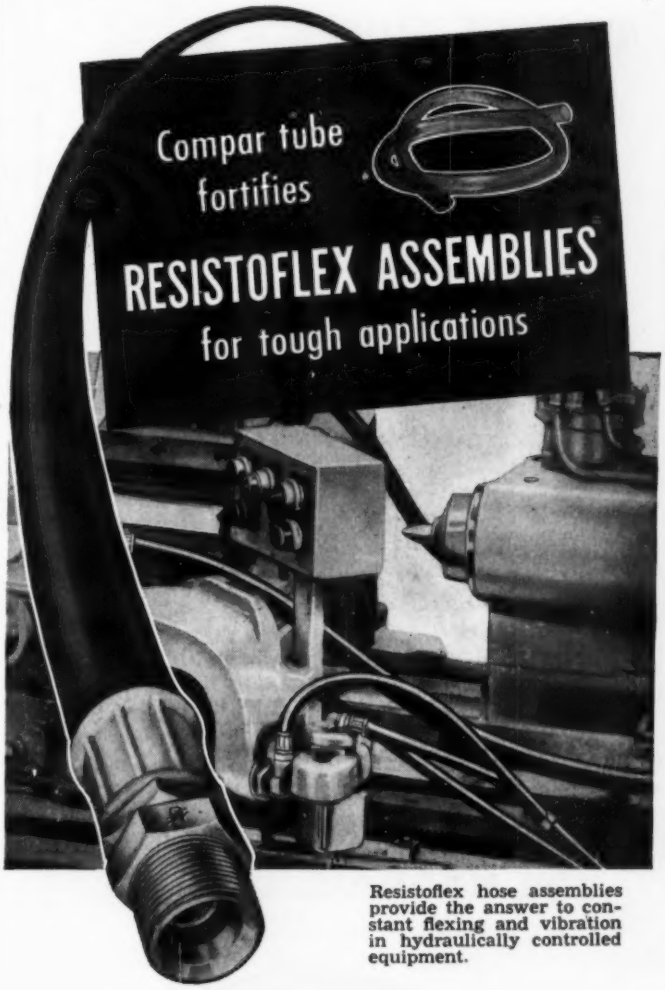

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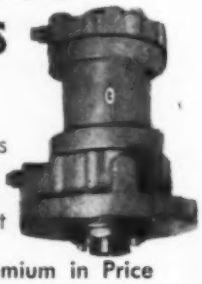

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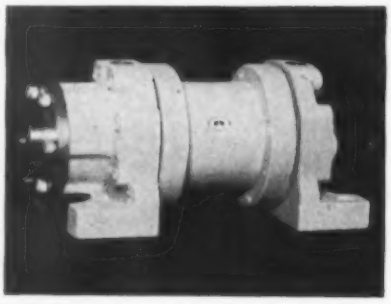

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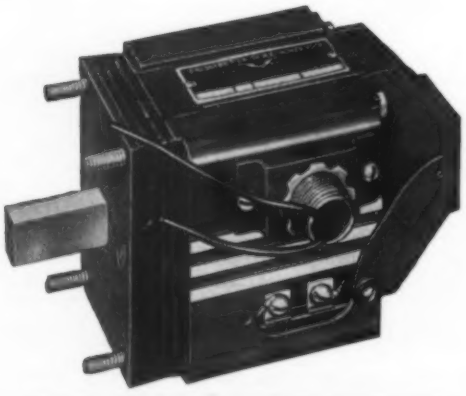

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A6.2.6 Industrial equipment shall be so designed as to facilitate easy replacement of packings.

A6.2.7 J.I.C. Standard part numbers shall be provided for all packings. If none available, principle dimensions such as inside diameter, outside diameter, stack height and material shall be provided.

A6.3—Cylinders and Pistons

A6.3.1 Cylinder bores having fitted pistons shall be finished in a manner consistent with the type of service intended and shall be free of porosity or other defects.

A6.3.2 Cylinders shall be located in alignment with work slides, and shall be such that no radial load shall occur on piston rod or ram, unless other suitable provisions are made to take such loads.

A6.3.3 Ends of cylinders shall utilize sealing devices that do not leak under manufacturers' intended operating conditions. Cylinder external sealing devices shall be readily accessible for servicing.

A6.3.4 (A) Cylinders shall be accessible for servicing.

*(B) Cylinders shall be separate, not cast integral with equipment.

*(See Engineering Developments, end of Standards).

A6.3.6 Piston rods shall be adequately protected by installation of cleaning and sealing devices. Material and hardness of piston rod shall be such as to prevent scoring.

A6.3.7 When pistons are assembled to rod they shall be positively locked.

A6.3.8 When necessary, cushions shall be provided on cylinder ends.

A6.4—Valves

A6.4.1 Adjustable valves shall be arranged so that wires and seals can be used after final adjustments and locking.

A6.4.3 When practicable subplate mounted valves (or equivalent) shall be used so that their repair or replacement can be made without disconnecting individual air lines. Seals of the pressure sealing type or seals of a type that will provide the equivalent of pressure medium sealing type are recommended. Means shall be provided so that subplate mounted valves cannot be improperly assembled to the subplate.

A6.4.5 The operation of a valve shall not contribute to detrimental surges in the pneumatic system.

A6.4.6 On vertical or inclined slides or rams means shall be provided to prevent rapid drop when air power is shut off.

A6.4.7 Solenoid operated valves shall be so designed, constructed and installed as to eliminate destructive hammering.

A6.5—Storage or Surge Tanks

A6.5.1 Tanks shall be so constructed as to conform to State Regulations. Where no regulations are in effect, they shall be so constructed as to withstand at least five (5) times the operating pressure of the pneumatic system they serve.

A6.5.2 Tanks shall be so designed and constructed that they can not be disassembled while containing an unsafe charge. Means shall be provided for safely relieving air pressure.

A6.5.3 Pneumatic circuits incorporating tanks shall be so arranged that the system can be bled at the low point of the circuit.

A6.5.4 See Paragraph A7.1.3 of the "Safety" section.

A6.5.5 Where applicable, all tanks shall incorporate suitable automatic condensate dump valves and suitably protected water indicators.

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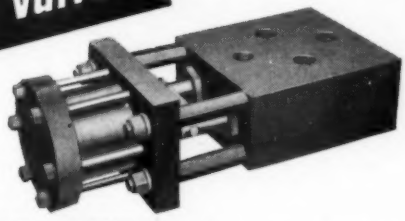
Quick-As-Wink AIR AND HYDRAULIC **Control Valves**

¾ Inch 4-Way — 5000 p.s.i. Pilot Hydraulic Valve



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For hydraulic systems to 5000 p. s. i.

● Designed for controlling double acting hydraulic cylinders. The pilot cylinder is controlled by any type of 4-way air valve and is operated either automatically or manually from a convenient control station. Machined steel housing, hard chrome plated ground and polished stainless steel plungers, molded packers sealed by valve pressure. All parts readily accessible without disturbing the piping. ½" to 4" sizes.

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Quick-As-Wink AIR AND HYDRAULIC **Control Valves**

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by **C. B. HUNT & SON, INC., 1964 E. Pershing St., Salem, Ohio**

A6.6—Storage or Surge Tank Nameplate

A6.6.1 The following information shall be permanently indicated on each tank:

(A) National Board Serial Number.
(B Name of manufacturer.
(C) Maximum allowable working pressure.
(D) Manufacturer's serial number.
(E) Year built.

A7 SAFETY

A7.1.1 Flexible lines shall be restrained or confined, if their failure might constitute a hazard to personnel.

A7.1.2 Operator shall not be required to reach past revolving spindles, moving tools, or moving machine or equivalent elements to reach manual controls.

A7.1.3 Pneumatic circuits incorporating storage or surge tanks shall be so interlocked as to vent or isolate pressure when power is shut off. On circuit applications where tank pressure is isolated full information shall be given on or near tank for proper servicing without injury to personnel.

ENGINEERING DEVELOPMENTS: Standard specifications noted with an asterisk (*) were written as a guide in indicating the type of engineering that is considered to be desirable in new developments and in the re-engineering of equipment.

The J.I.C. Pneumatic Standards for Industrial Equipment provide performance standards for the application of pneumatics which will provide safety of personnel, uninterrupted production long life of the machine, equipment or tool. Please preserve for future reference.

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Double End Rod Mounting

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AVIATION SECTION
HYDRAULICS • PNEUMATICS
DESIGN
OPERATION
MAINTENANCE

RALPH E. MIDDLETON
Advisory Editor

Design of "Fluid Bridge" Control Valves

By RODNEY B. CAMPBELL

WHILE THE TERM "FLUID BRIDGE" IS NEW, IT employs one of the basic laws of hydraulics, namely, Pascal's conclusion that pressures applied to confined fluids are transmitted equally in all directions. Actually, it is a thoroughly honest trade name, sufficiently accurate and descriptive of its function to satisfy the engineer or physicist. Perhaps the best description of its practical application will be found in a study of its use in a shut off valve illustrated in Figure 1.

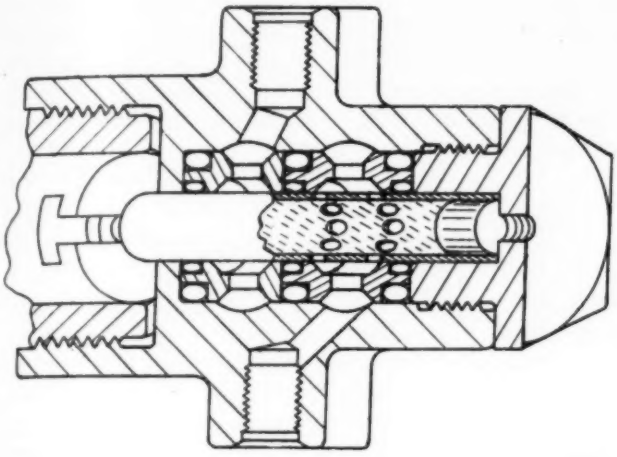
The moving element consists of a closed cylinder with two series of holes drilled around the wall. In the OFF position, the cylinder is moved to a position in the body exposing all perforations to the pressure source. The outlet is isolated by standard "O" ring packings applied conventionally to the cylinder surface on either side of the perforations, and in accordance with Pascal's law we have equilibrium as well as zero leakage.

As the cylinder (in equilibrium) is moved to effect the valving operation, the first series of perforations is brought in contact with the packing separating the pressure inlet cavity from the outlet cavity. At the instant of contact the packing seal is relieved, BECAUSE THE PRESSURE FORCES ARE APPLIED (FROM WITHIN THE CYLINDER) AT A POINT OF PACKING CONTACT NEUTRALIZING PACKING LOADS. Actually, the packing itself is placed in equilibrium and permits the cylinder to travel with minimum friction.

In the ON position we see, Figure 2, that the cylinder location in the housing is such as to expose one series of perforations to the pressure source cavity and the other series of perforations are open to the outlet cavity. The fluid path is now open from the valve inlet port, around the pressure cavity, through the cylinder, around the

Fluid bridge design meets stringent aircraft leakage requirements while providing valves which can be readily assembled. During normal service life there is no significant wear to any components except packings.

Fig. 1. In the closed position, the cylinder, which is the fluid bridge, is moved to expose all perforations to the pressure source. The outlet is isolated by "O" ring packings.



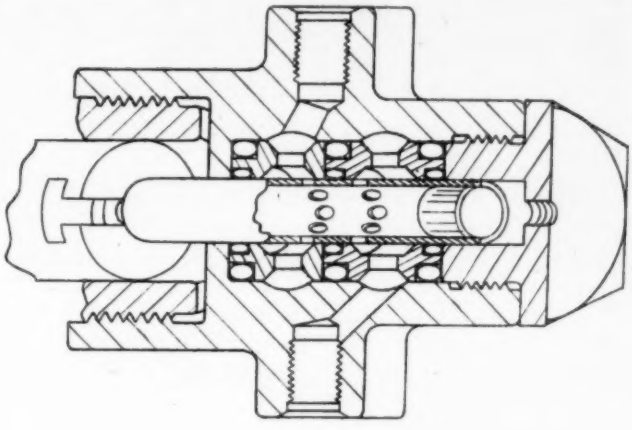


Fig. 2. In the open position, the cylinder is moved to expose one series of perforations to the pressure source and one to the outlet cavity. During cylinder movement the packing loads are neutralized by fluid pressure to minimize friction.

outlet cavity and out the outlet port.

From the foregoing description, it can be seen that the fluid bridge component is the closed cylinder. When the perforations in the bridge are exposed exclusively to system pressure the bridge is closed. When the bridge is moved in the valving function, as pointed out earlier, internal pressure neutralizes packing loads bridging the obstruction between the inlet and outlet ports of the valve, providing a low pressure drop fluid passage. One of the requirements in this design is that fluid pressure must always flow into the inner chamber of the fluid bridge through one or more series of holes (depending upon the flow requirements) and out of another series of holes.

Figure 3 illustrates a selector valve, which is actually composed of two separate 3 way valves, operated by a single handle. The purpose of this particular design is to select one of two pressure sources and connect it through the bridge to a supply line or to a utility. As illustrated in Figure 3, the pressure valve is the smaller of the two bridges in the upper portion of the assembly. In the position shown, the pressure from supply con-

New Aviation Section Editor

We are pleased to announce the appointment of Ralph E. Middleton, hydraulic design specialist, Lockhead Aircraft Corporation, Burbank, Calif., as advisory editor of the Aviation Section of APPLIED HYDRAULICS.

Mr. Middleton was graduated in aeronautical engineering from the University of Michigan in 1929; till 1940 he was with the Army Air Corps at Wright Field, the last five years in charge of the hydraulics laboratory. He was then successively landing gear staff engineer for Curtiss-Wright at St. Louis, chief engineer, Aircraft Accessories Corporation and head of a small manufacturing business. He joined Lockheed in July 1950 as a design specialist.

Our new Advisory Editor is a long-time member of SAE A-6 Committee, Aircraft Hydraulic and Pneumatic Equipment.

nected to P1 is closed off. The bridge used in this particular installation consists of two separated chambers. Pressure from P1 enters the cavity, fills the bridge chamber and is static, since both series of perforations are exposed to the same pressure. Pressure entering P2 enters the second

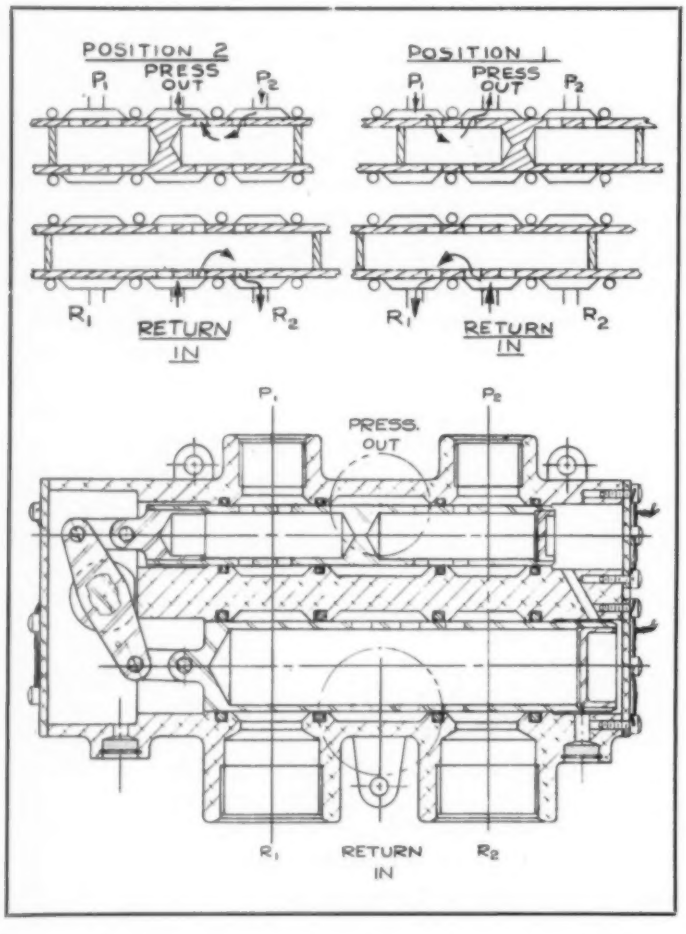


Fig. 3. Two separate 3 way valves operated by a single handle, form this selector valve. One of two pressure sources may be selected and connected to a supply line or utility.

chamber of the bridge through one series of perforations, passes through the bridge and out the second series of perforations located in the outlet cavity. Alternate selection by the simple matter of moving the handle is readily envisioned by study of the figure.

A provision for returned fluid flow is contained in the second and larger bridge, the lower portion of the illustrated assembly. This particular bridge is a closed cylinder with a single chamber, and contains three series of perforations. The illustration clearly shows how the linkage provides for simultaneous valving of the returning fluid with selection of the pressure source. The fluid returning from the utility system enters the bridge through two series of perforations and passes out of R2 whose cavity is connected by one series of perforations. As shown in the illustration, R1 is completely isolated, since no outlets to the bridge are open to the R1 cavity. It is obvious that moving the handle simply reverses the entire process.

Eliminate Manual Utility Control

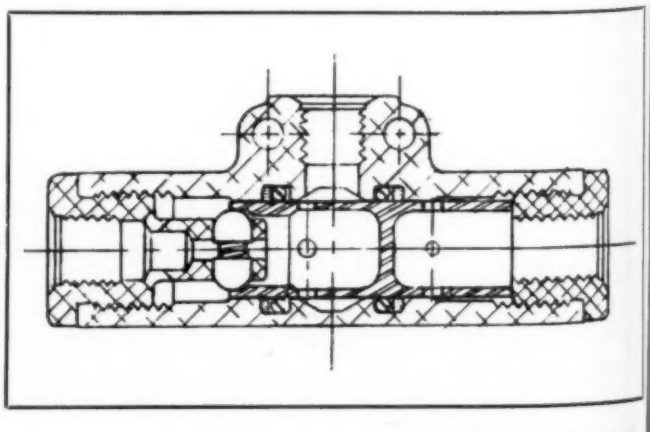
Figure 4 illustrates still another application of the fluid bridge as applied to a shuttling function. Since the shuttle may be new to engineers in the industrial field, it is perhaps worth while to discuss the shuttling problem so as to make clear the particular advantage of the fluid bridge in a shuttling operation. Consider then a juncture of three lines of plumbing, two of which are connected to a separate source of fluid (liquid or gas) energy. The third line is connected to a utility of one kind or another. Conventional plumbing practice has met this problem by the simple, if expensive, installation of shut off valves in each supply line ahead of the tee. A manual operation is all that is necessary to gain whatever selectivity is required, but the manual operation is prerequisite.

There are many ramifications of this in daily service, some of which are made automatic by sensing devices with various means for powering the valving operation.

A straightforward approach is through the use of a pair of check valves. They will automatically connect the utility to the source of greater pressure and the greater the pressure difference the less intermingling of pressure media will occur.

The shuttle valve provides for a requirement not possible with check valves. Once a shuttling

Fig. 4. The fluid bridge design applied to a shuttle valve.



operation is complete the connection is open to flow in either direction, unaffected by back pressures from the utility. Only a dominant pressure from the isolated supply will reverse the shuttle slide position and establish a similar connection to the new source.

Operation of the Shuttle Valve

The bridge used in the shuttle is again cylindrical, open at the ends with a closed center. The body is provided with pressure ports at either end of the long axis with a common outlet in its center.

A dominant pressure from either source will force the slide to move to its extreme limit of travel in one direction or the other. The drilled holes in the slide wall will pass beyond the packings with slide movement and the packing seal reestablished. In this position one side of the bridge is open to the utility port, the liquid entering through the hollow bridge and out of the drilled passages into the center chamber connected to the utility port. The opposite supply is sealed off by the packing between the openings in the bridge wall.

This, then, is a unit that would seem to meet all demands except one. In the so-called "plugged line condition" it is assumed that fluid is trapped throughout the system from the utility through the shuttle to the connected source. Even though the condition is static and no pressure is present, it is apparent that a pressure from the opposite source acting against the bridge will produce a correlative pressure opposing the slide movement. Theoretically we have a stymie. Actually fluids have some compressibility and connected lines and accessories will yield significantly under pressure. Initial bridge movement on the application of a reverse pressure is sufficient to move the ports in the bridge under the packings in the shuttle body and break the seal. A restricted flow is now established from inside the bridge on either side of its center to the utility port and the bridge travels in its normal shuttling manner until its actuation is complete.

Detents Establish Pressure Limits

Detents are provided to prevent "intermediate or interflow" condition. The detents will stabilize the bridge by restricting its travel to given pressure limits, depending upon the value of detent spring. Therefore, depending upon the spring used, a corresponding pressure will build up before overcoming the detent, and in pneumatic applications, once released, the bridge snaps through its full travel to its alternate flow position. In liquids, where the function is important, detent action can be provided to meet specification requirements.

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Aviation Notes

THIS MONTH'S NEWS OF PEOPLE, PRODUCTS, MEETINGS AND MANUFACTURERS

Regular semi-annual meetings of SAE Committees A-1, A-3 and A-6 will be held the week of April 23-27 at the Van Cleve Hotel, Dayton, Ohio. Chairman J. Milton Kidd of Committee A-1, Aircraft Pumps announces that his committee will meet on Tuesday April 24; Chairman L. J. Henderson of Committee A-3, Aircraft Valves, Fittings and Flexible Hose Assemblies will call his group together on Monday morning April 23. The larger group, the A-6 Committee on Aircraft Hydraulic and Pneumatic Equipment, will meet for the three days following the A-1 and A-3 meetings, Wednesday, Thursday and Friday, April 25, 26 and 27. B. R. Teree is chairman of the A-6 Committee.

Ira E. Weston, president, Weston Hydraulics, Ltd., North Hollywood, Calif., announces two important additions to their organization: **H. F. Gerwig** as chief design engineer and **Fred O. Hosterman** as chief sales engineer. Gerwig is a pneumatics design specialist, Hosterman is well known in the hydraulics field.

George B. Sisley has been appointed production manager of Pacific Airmotive Corporation's Manufacturing Division, according to an announcement by vice president **Richard D. Maystead.** Sisley has been on the staff of Kirk Engineering Co. as consultant to PAC; his background includes posts as assistant manager of tooling at Spicer Manufacturing Co. and general manager of the Ordnance Division of Willis Overland.

Air Force pool of 40,000 machine tools, assembled after World War II as one phase of the Joint Army-Navy Machine Tool Program, is now being made available to contractors on a loan basis. The operation of this plan is expected to shorten time between first contract and first production model plane by as much as 18 months. These tools, valued at $400,000,000, were bought up by RFC, turned over to WAA and acquired by AF; they will remain government property while in use in industry and will be returned to Air Force custody upon termination of contracts involving their use for defense production.

Sprague Engineering & Sales air operated, oil dispensing unit delivers clean, filtered oil to an airplane reservoir. The Model 277 is portable and contains all necessary controls and hoses for complete service. Oil is pumped by an air operated pump, providing maximum safety. All dispensed oil passes through two micronic filter elements in series; the unit pumps oil from a storage tank or container by its own power system.

Keeping up with increased demand for "O" ring seals and other molded rubber parts, The Parker Appliance Company has started construction on its subsidiary plant, Berea Rubber Company.

New rotary gear air motor, designed for emergency actuation of such aircraft units as a pilot's canopy and useful wherever high pressure air is available, is available from Romec Div., Lear, Inc. Designed for flange mounting and displacing .310 cu in, the unit operates on an air pressure of 1500 psi, rotates in either direction and has 44 in-lb torque at 1000 psi and zero rpm.

NOW! A compressor that delivers volume at 35,000 feet!
At last we can tell you about the Kidde high altitude compressor! After years of intensive testing, Kidde engineers have released it for aircraft installation.
Here's what it will do:
At 35,000 feet altitude, this new lightweight Kidde compressor will, from ambient pressure, deliver one cfm of free air compressed to 3,000 psi. At sea level it will deliver four cfm of free air compressed to 3,000 psi. With pressurized inlet air, the sea level performance can be maintained at altitude.
With this Kidde compressor, pneumatics for aircraft use takes another step forward. No other power system is so light in weight or has its required medium so readily available.
Why not take advantage of Kidde's years of experience in the field of pneumatics. Call us if you have a problem in actuating airborne equipment pneumatically. We'll be glad to help.
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Report on West Coast Committee Gives Second Year's Progress

THE COMMITTEE ON HYDRAULIC and Pneumatic Systems, an activity of the Southern California Section of the American Society of Mechanical Engineers, and sponsored jointly with the American Society of Civil Engineers, the Society of Automotive Engineers, the American Institute of Electrical Engineers, the Institute of Aeronautical Sciences and the American Rocket Society, has completed its second year of operation. Two activities—the preparation of a "Recommended Good Practice Manual" and the conduct of series of technical meetings or seminars, have been continued through this period.

J. S. Newton, research engineer at North American Aviation, Inc., originally elected vice chairman of the Committee, succeeded Howard Field, Jr., in November, 1949, when Mr. Field resigned for reasons of health. During 1950, W. J. Williamson resigned as secretary and E. M. Vance succeeded him for a short period. The new and present secretary is Howard Stevens, sales manager of Barksdale Valves. H. K. Palmer, consulting engineer and H. E. Karig, section engineer at the Navy Ordnance Test Station at Pasadena serve as vice chairmen.

The activities of the Committee during 1950 were a direct continuation of those in 1949 and consisted of the following phases:

(1) The preparation of a manual on recommended practices in the selection, design, development and testing of hydraulic and pneumatic operating and control systems.

(2) A seminar on specific applications of hydraulic and pneumatic systems in industry.

(3) A seminar on design analysis of hydraulic and pneumatic systems.

(4) Preliminary preparations for a national symposium.

Progress on the "Recommended Good Practice Manual" continued during the year. The general policy for the preparation of the Manual was worked out in detail and proposed outlines for contents revised and amplified. Memorandum No. 0-7, dated September 4, 1950, issued by the Committee, contains the outlines of the proposed contents.

Since the effect of the Korean War became felt in industry, the Committee members have had to limit their participation to a large extent, and at present, it appears likely

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- Line — for line mounting to safeguard sensitive equipment.
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- One-way—Accurate flow in one direction — free flow in opposite direction —
- Restrictor adequately protected by filtering elements*.
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Kenyon will be pleased to take care of your needs. Just advise as to your requirements—

Kenyon can make it!

*Filtering elements will remove foreign particles in excess of .008.

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that publication of the Manual will be greatly delayed. However, efforts are being made to obtain priorities for the preparation of the Manual on the basis of the value of such a publication to industry.

The seminars on specific applications and on design analysis of hydraulic and pneumatic systems were held; eight meetings were held during the year. Speakers and subjects were: "Industrial Applications of High Pressure Hydraulic Systems for Power Transmissions" by Herb Vickery (APPLIED HYDRAULICS, January, 1950, pp 11-13, 30); "Hydrodynamic Power Transmissions", by Dr. Peter Kyropoulos; "Practical Applications of Hydraulics to Oil Well Pumping Equipment", by C. J. Woodard, I. M. White and D. P. Billings; "Pressure Weight Relations in Hydraulic Systems" by Fred Mittel; "Dynamic Considerations in the Design of Hydraulic Systems for Aircraft", by Harold Raiklen; "Solution of Hydraulic System Dynamic Problems by Electrical Analogy", by S. D. Millstone; "Boost Valve Characteristics and an Application", by J. C. Monroe and "Dynamic Characteristics of Hydraulic Transmission Lines", by K. G. Hart.

Progress also was made in preparation for a national symposium and a total of 11 papers were presented in rough draft form by members of the Committee: "Notes on Principles of Cavitation Shock and Water Hammer" and "Pressure-Time Relations in Hydraulic and Pneumatic Systems" by H. K. Palmer; "Hydrodynamic Power Transmissions" by Dr. Peter Kyropoulos; "Proposed SAE Aernonautical Recommended Practice Nomenclature", by G. H. White; "Dynamic Analysis of Servo Control Systems", by Alyce Coke; "Dynamic Considerations in the Design of Hydraulic Systems for Aircraft Surface Controls", by Harold Raiklen; "Solution of Hydraulic System Dynamic Problems by Electrical Analogy", by S. D. Millstone; "Boost Valve Characteristics and an Application", by J. C. Monroe; "Dynamic Characteristics of Hydraulic Transmission Lines", by K. G. Hart; "Petroleum Type Hydraulic Fluids", by A. J. Zino and "Basic Analysis of Accumulators and their Applications in Hydraulic Systems", by H. K. Palmer.

Unfortunately, the press of a war economy makes it appear that the symposium will have to be postponed indefinitely.

The Committee solicits the aid of interested, qualified persons in the preparation of the Manual and encourages nonmembers to contribute to the Manual. Correspondence regarding the Committee may be addressed to Mr. Stevens, secretary, 1566 E. Slauson Ave., Los Angeles 11, or to the chairman, J. S. Newton, 6070 South Noroco Drive, Rivera, California.

THE PERFECT-*Tie-up*

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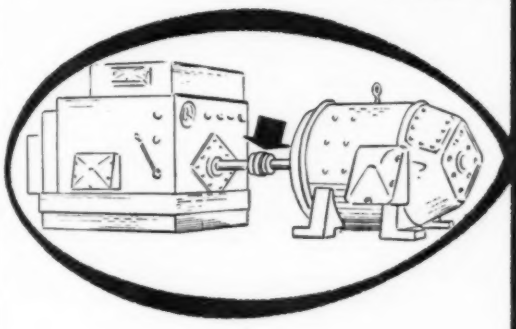

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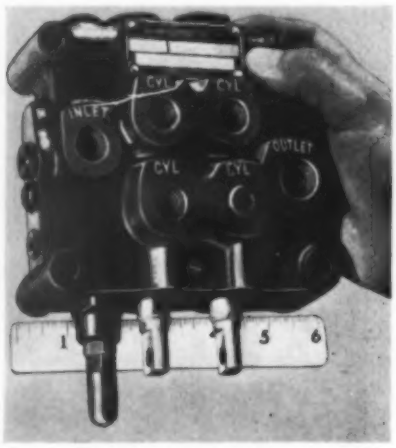

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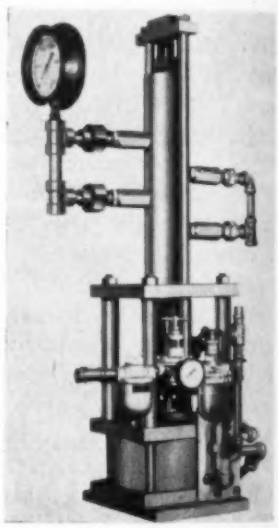
LARGE DIAMETER CYLINDERS: 15, 30 and 195 TONS — Large diameter cylinders of 15, 30 and 195 tons lifting power are now being offered by Miller Motor Company. The 20 in diameter model air cylinder produces over 30 tons of lifting power at rated operating pressure of 200 psi. This is the counterbalance type of air cylinder which is particularly adaptable for use in presses and other heavy production machinery and is also available in 18, 16, 14, 12, 10 and 8 in bores.

At its rated 2500 psi operation under shock load conditions, the 12 in bore model high pressure hydraulic cylinder produces over 140 tons of thrust and, in non-shock load condition, produces over 195 tons of thrust at 3500 psi operation. Like their smaller models, these large diameter cylinders have non-breakable solid steel heads, caps, and mountings, scratch-resistant, hard chrome plated piston rods, piston rod dirt wipers, precision-honed barrels of 15 micro inch finish, and self-regulating, wear compensating, leakproof and tamperproof seals that never require adjustment. The standard air and the counterbalance type air cylinders have non-corrosive brass barrels to eliminate rust from air moisture. The cylinders are offered in a wide variety of convenient mounting styles and, with the exception of the counterbalance type air cylinders, are available in double rod end styles also.

Circle 101 on Reader Service Card

HYDRO - PNEUMATIC PUMP — The Aldrich Pump Company has recently completed design improvements on the Aldrich-Lytle Hydro-Pneumatic Unit. This pump is self-contained, uses normal plant air as the power medium and provides high pressures, up to 20,000 psi at small volume. The unit has been made more compact, lighter in weight and incorporates other refinements in design. Its use in testing tubing, valves and pressure vessels, in the operations of small molding presses, and in other services requiring high pressure at small volume has proven highly satisfactory.



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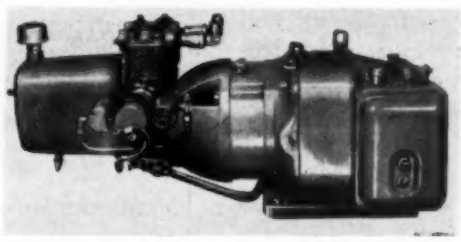
PACKAGED PRESSURE OIL SYSTEM—Plants interested in building simple hydraulic presses, jigs, clamps, or fixtures will find the completely packaged hydraulic system designed by Harco Industries compact and highly adaptable. Solid coupling of motor and pump eliminates drive belts, lessens repair costs or work stoppage through mechanical breakdown. New design also minimizes pressure flutter and overheating due to maintenance of pilot pressure with large volume installations. More than 100 models offer ranges of 1.8 to 8.05 gpm, pressures up to 1000 psi. This power package may be used as complete hydraulic system or as pilot system on large installations, it includes motor, solid coupling, vane-type pump, reservoir, oil cooler, air filter, overload valve, pressure regulating valve and 3- or 4-way valve or combination of both.



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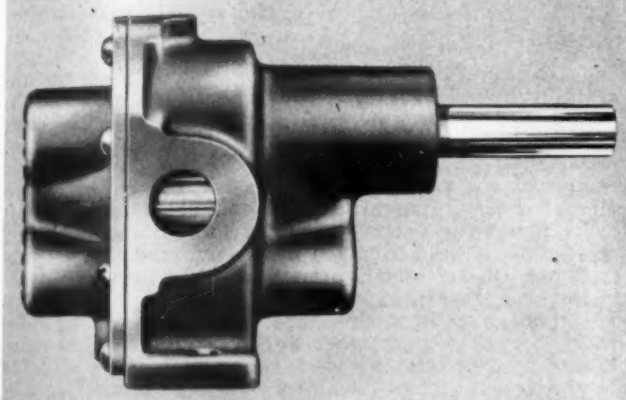
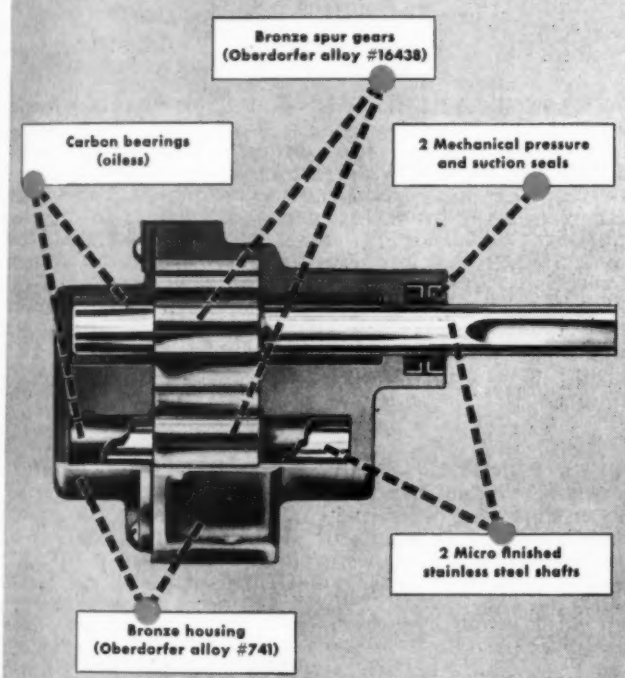
OBERDORFER INTERNATIONAL BRONZE ROTARY GEAR PUMPS




Bronze spur gears (Oberdorfer alloy #16438)
Carbon bearings (oiless)
2 Mechanical pressure and suction seals
2 Micro finished stainless steel shafts
Bronze housing (Oberdorfer alloy #741)

These precision built pumps have been specifically designed for long and economical industrial service, and to reduce liquid transfer costs in the vast variety of applications where they are suitable. Their five major points of superiority incorporate all the engineering and production knowledge amassed in building literally millions of bronze pumps over a period of more than 50 years. These new Series 1 OBERDORFER INTERNATIONAL pumps will prove their worth in intensive, on-the-job tests against any competitive pumps on the market today.

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1725 RPM (Standard Electric Motor Speed)						
Pump Size	2 lbs.	20 lbs.	40 lbs.	60 lbs.	80 lbs.	100 lbs.
No. 1½	126	115	105	98	93	90
No. 2	245	225	215	205	195	190
No. 3	445	425	405	390	380	370
No. 4	640	610	580	550	530	510
No. 7	1185	1160	1140	1120	1100	1085
No. 9	1400	1375	1350	1325	1300	1280

PRICE LIST

Oberdorfer International Series 1
IMPORTANT: Order by Part Number

1½	2	3	4	7	9
Part No. 1000	Part No. 2000	Part No. 3000	Part No. 4000	Part No. 7000	Part No. 9000
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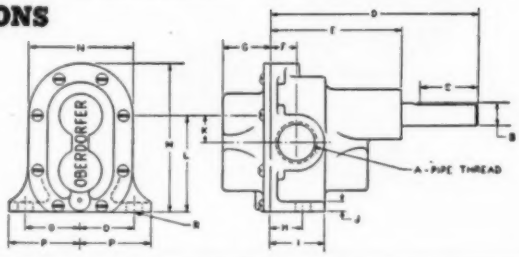
DIMENSIONS



PUMP No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R
1½	¼	½	1	3 5/16	2¾	3/8	1 3/8	5/8	1 1/4	3/8	15/32	1 5/8	2 3/8	1 13/16	3/8	1 1/4	3/4
2	3/8	½	1	3 11/16	2 5/8	15/32	1 1/4	3/4	1 3/8	1/4	7/32	2 5/8	3 1/4	2 3/8	1 1/8	1 3/4	3/4
3	½	5/8	1¼	4 1/16	3	15/32	1 1/4	¾	1 1/4	½	¾	2 1/4	4	2 3/4	1 3/8	1 7/8	15/32
4	½	5/8	1½	5 1/16	3 3/8	15/16	1 1/4	⅝	1 5/16	½	¾	2 5/8	4	2 3/4	1 3/8	1 7/8	15/32
7	¾	5/8	1½	5 5/8	3 3/8	¾	1 1/4	⅝	1 3/8	½	1	3 1/4	5 1/4	3 3/4	1 1/8	2 1/8	15/32
9	1	5/8	1¾	5 5/8	3 3/8	7/8	1 1/4	⅝	1 11/16	5/8	1	3 1/4	5 1/4	3 3/4	1 1/8	2 1/8	15/32

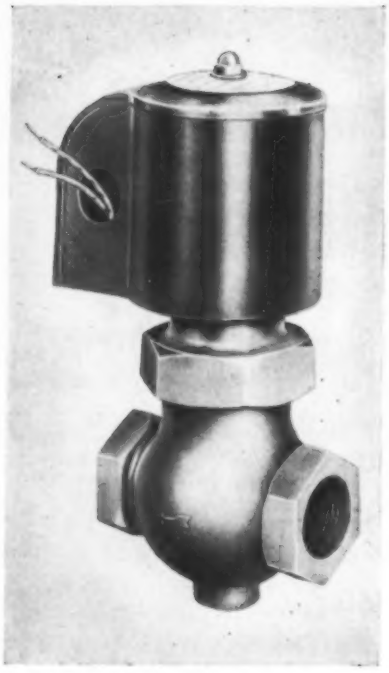
FACTS ABOUT OBERDORFER

1. The third largest non-ferrous foundry in the U. S.
2. Over a half century of bronze pump manufacturing experience
3. Long-established world-wide pump distribution
4. Millions of pumps in service
5. Capitalization over one million dollars
6. 1951 capacity for 250,000 Series 1 OBERDORFER INTERNATIONAL pumps

* First of five new series

Write Dept. AH-514

INDUSTRIAL PUMP DIVISION
Oberdorfer Foundries, Inc.
Syracuse, N. Y.

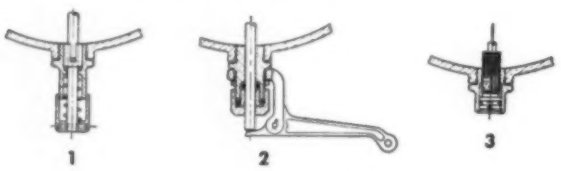


Bulletin 8210

General Purpose Control Valves

★ **Full Port Area—Packless**
★ **For Air, Gas, Water, Brine, Freon, Methyl Chloride, Light Oil and other Liquids and Gases up to 212°F; Pressures up to 400 pounds**
★ **Several Auxiliary Variations**
★ **Several Sizes: ½ to 2½ inches**

Our Bulletin 8210 Solenoid Valves are designed for those shut-off requirements where a simple, rugged, automatic control will serve. They close instantly when current to the coil is cut off. Full line pressure on top of the valve piston aided by a powerful spring assures tight closing. They reopen fully when the coil energy is restored. Only minimum current is required because the solenoid, when energized, is required to open only the small pilot port against the line pressure. The construction is such that the valve is held open by the solenoid for full pipe area independent of the flow through the pipe line.



Three auxiliary variables are available: (1) device for locking the valve in open position; (2) device for utilizing the valve for whistle control; (3) by-pass adjustment for holding the valve open.

Bulletin 8211 Valves are similar except that they have Explosion-Proof Solenoids approved by Underwriters' Inc., Class 1, Group D, Hazardous Location.

ASCO Solenoid VALVES

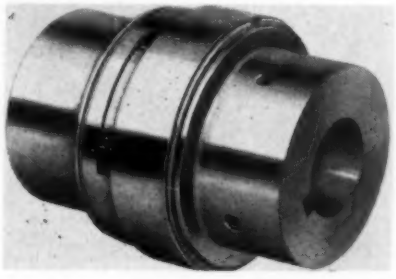
If you have any automatic control problems that fit into the above class, you might study fully the merits of Asco Bulletin 8210 and 8211 Solenoid Valves. Write us anyway, regardless of your problems, because we have many other types of solenoid valves.

When in need of Electromagnetic Controls, come to us.

Automatic Switch Co.

385H LAKESIDE AVENUE · ORANGE, NEW JERSEY

NEW FLEXIBLE COUPLING FEATURES—Extra ease of installation, larger bore capacities, are important features provided by the improved Lovejoy L-R Type "C" and "H" couplings. These couplings are designed for use on motor driven or engine driven pumps, compressors, generators, pulverizers and almost all machinery of 50 to 1,000 hp. Heavy couplings are of electric cast steel. In these new couplings, the inside sleeve is made in two parts, instead of one to provide a sleeve in each coupling. Both bodies are machined alike for the removable steel collar. This makes it easy to put the collar on either half of the coupling. The collar is held in place by a snap-ring. The couplings adjust for misalignment, shock, vibration, oscillation, surge or backlash. Also, half of the cushions are idlers, except on reversing load; hence, there is always a set of new cushions in the coupling. This eliminates shut-downs, as load cushions can be quickly interchanged without tearing down coupling.

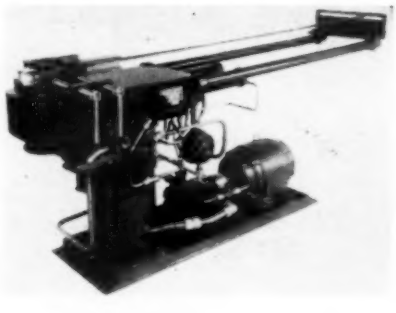


Circle 104 on Reader Service Card

PULSATION FREE PUMP — Vickers Inc. has made available a "Wafer Kit" for their aircraft constant displacement piston type pump. This kit includes a metered valving wafer which is to be inserted between the pump housing and valve plate. The wafer incorporates a metering groove in one end of the pressure port kidney. Tests have proved that the metering groove provides quieter hydraulic system operation. Pump noise level has been reduced 90 per cent. In aircraft, where pump pulsations have caused failures, the use of this wafer kit will prove invaluable.

Circle 105 on Reader Service Card

TUBE BENDER — Wallace Supplies Mfg., Co. offers a small compact bending machine only 21 in wide by 34 in high and 78 in long for space saving, with power well beyond its capacity of 1¼ in O.D. x 16 BWG steel tubing. The unit is powered by a standard 2 hp 220/440 v, 3 phase, 60 cycle motor furnished with the bender. It is operated by a single lever which when pushed down causes the bending arm to swing around to the degree of bend selected and stay there until the operator has removed the bent part, then the lever is moved up and the arm swings back to its original position. The bending die is held by spring clips, for easy changing. This die is a combination die with four different sizes, one to each side. The bender can be changed simply and easily from a right hand bender to a left hand bender by changing the pressure and clamping arms over and inserting the bolts into holes ready for that purpose. It is all welded construction and the 10 in steel pipe to which the top and base is welded is also the tank containing the hydraulic fluid,



Circle 106 on Reader Service Card

BUYER'S GUIDE

Accumulators
Edit. p. 25
Adv. p. 23

Boosters
Edit. p. 28, 32
Adv. p. 7

Bronze Bearing Parts
Adv. p. 76

Compressors, Air, Industrial
Edit. See JIC STDS, part A3

Compressors, Air, Aviation
Edit. See JIC STDS, par A3
Adv. p. 57

Controls, Pneumatic
Edit. JIC STDS, par A2

Couplings, Flexible
Adv. p. 59

Couplings, Hydraulic, Rotary
Adv. pp 37, 39

Cylinders, Air
Edit. pp 27, 28. See JIC STDS, par A6.3
Adv. pp 6, 14, 38, 47, 50, 51, 64, 71, 78

Cylinders, Hydraulic
Edit. pp 25, 28, 51
Adv. pp 14, 47, 50, 51, 64, 71, 80

Filters, Air
Edit. See JIC STDS, par A6.1
Adv. pp 46, 78

Filters, Oil
Adv. pp 8, 58, 67, 70

Fittings, Hose
Edit. p 28, See JIC STDS par A4
Adv. pp (Cover) 2, 4, 5, 37, 39, 45, 49

Flexible Metal Hose and Tubing
Adv. pp 39, 49

Fluid Motors
Adv. pp 3, 16, 69

Hose, Air and Oil
Edit. p 28, See JIC STDS par A4
Adv. pp (Cover) 2, 39

Hose Assemblies
Edit. p 28, See JIC STDS par A4
Adv. pp 4, 5, 37, 39, 45, 49

Hydraulic Fluids
Edit. pp 25, 28, 52
Adv. p 24

Lubricator, Air Line
Edit. p 29, See JIC STDS par A6.1

Motors, Electric
Edit. pp 25, 27, 28
Adv. p 75

Package Power Unit
Adv. Cover 3

Packings, Cup
Adv. pp 12, 18, 48

Packings, Flange
Adv. p 48

Packings, Oil Seal
Adv. p 9

Packings, "O" Ring
Edit. p 52
Adv. pp 9, 13, 46, 68, 77, 79

Packings, "U"
Adv. p 48

Packings "V"
Adv. pp 9, 10, 48

Plugs, Pipe
Adv. p 76

Pressure Gauges
Edit. pp 28, 32
Adv. p 38

Pressure Switch
Edit. p 28
Adv. p 71, 73

Pumps, Gear
Edit. pp 25, 30
Adv. pp (Cover) 3, 20, 21, 22, 33, 55, 61, 63

Pumps, Piston
Adv. p 11, 15

Pumps, Rotary Piston
Adv. p 69

Revolving Joint
Adv. p 72

Rod Wiper
Adv. p 73

Sealing Devices
Edit. See JIC STDS, par A6.2

Solenoids
Edit. pp 25, 28
Adv. p 50

Timers
Edit. p 28

Transmissions, Hydraulic
Adv. p 3

Valves, Air
Edit. pp 27, 28, See JIC STDS, par A6.4
Adv. pp 1, 43, 44, 48, 49, 74, 78

Valves, Hydraulic
Edit. pp 25, 32, 52
Adv. pp 15, 16, 20, 43, 51, 62, 64, 65, 70, 74, 76, 80

PLENTY of POWER

IN THESE HYDRAULIC PUMPS and FLUID MOTORS

There's plenty of power in Eastern fluid motors and hydraulic pumps. They're tough and compact—ideal where space is at a premium. They're dependable, too. Long life under rugged operating conditions is built-in. An Eastern hydraulic pump or fluid motor in your design is good engineering.

SERIES 100

.1 to 5 GPM—Drive speeds up to 3450 RPM. Working pressures up to 1000 PSI. Average volumetric efficiency: 90%. Average model weight: 1.65 lbs.

Lightweight construction is obtained through use of aluminum housings and nitralloy gears and shafts. Each unit is factory pre-tested for precision and operating efficiency.

WRITE FOR FULL DETAILS

Eastern INDUSTRIES, INC.
298 ELM STREET
NEW HAVEN 6, CONNECTICUT

Circle 74 on Reader Service Card

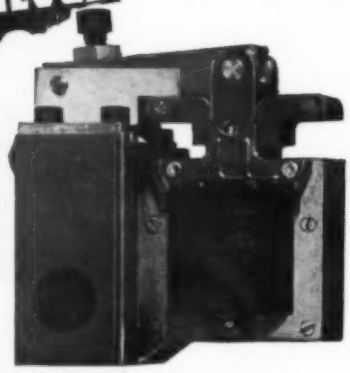
Circle 30 on Reader Service Card

NEW HIGH PRESSURE
SOLENOID VALVES

Now available in 110 —220—440 volts 60 cycle A. C. current

Features

- Rugged compact construction
- 3000 P.S.I. operating pressure
- Continuous duty
- Poppet design eliminates leakage
- May be mounted in any position
- Impregnated coils resist moisture and condensation



Waterman High Pressure Solenoid Valves are inexpensive, compact units designed for continuous duty in hydraulic systems where pressures are as high as 3000 P.S.I. Poppet type construction gives positive sealing against internal leakage. Impregnated oil resistant coils make these valves suitable for mounting in oil reservoirs. In many cases this feature eliminates costly piping and makes possible the construction of smaller, more compact hydraulic power units. Available in ⅜" pipe size. Electrical requirements are 110 —220—440 volt—60 cycle A.C. current.

West Coast: H. E. Webb, 918 No. Kenilworth Ave., Glendale 2, Calif.

WATERMAN ENGINEERING *Company*

721 CUSTER AVENUE • EVANSTON, ILLINOIS

PEMACO HYDRAULIC AND AIR CYLINDERS
with the NEW
Cartridge Type Packing Gland

Designed to J. I. C. Hydraulic Standards

Pemaco Hydraulic Cylinders are soundly engineered—give long life and top performance. The steel ram is hardened to 50.C Rockwell, ground and lapped. NOW the Pemaco has the first self-contained Cartridge Type Packing Gland.

This new Pemaco "EASY-PAK" Gland is designed to comply with J.I.C. Standards. It combines double bearing surface, low friction ram seal, and a ram wiper into a single compact unit. Easily maintained, the Pemaco "EASY-PAK" Cartridge Type Packing Gland can quickly be replaced in most cases without removing the cylinder from the machine — and by inexperienced help — greatly reducing machine down-time.

Pemaco "EASY-PAK" Cartridge Type Packing Glands are manufactured for both hydraulic and air cylinders.

PETCH MANUFACTURING COMPANY

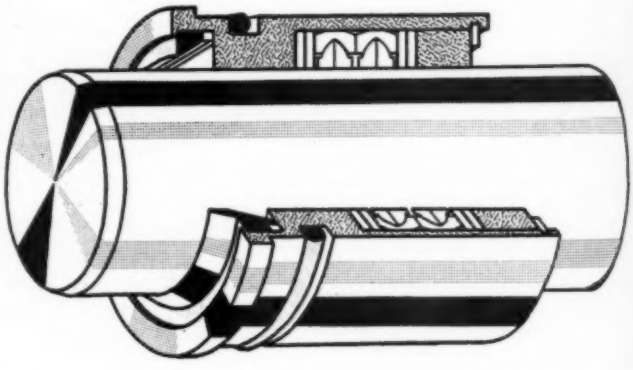
Write for complete information and engineering data.

36100 HARPER AVE.
MT. CLEMENS, MICH.

BRONZE CONSTRUCTED SOLENOID SHUT-OFF VALVE—Corrosion resistant solenoid operated shut-off valve manufactured for instant control of all types of fluid pressure operated equipment and machine process applications has been designed and manufactured by Airmatic Valve, Inc. The new model called the LDS-2-750 direct solenoid two-way capacity shut-off valve features positive seal, ports in line, and only one moving part. Constructed of cast naval bronze, it is corrosion - proof throughout. Pressures range from 0 to 225 psi and operates on AC or DC. This new model, will control oil or air and can be mounted in any position without harm to the valve or solenoid. The compact design of this valve, available in sizes ¼ to 2 in, permits use in restricted space.

Circle 107 on Reader Service Card

SELF-CONTAINED PACKING ASSEMBLY — Introduced by the Hydraulic Accessories Company, MONO-PAK cartridges for pneumatic and hydraulic cylinders, provide as extremely simple solution to problems of assembly and maintenance. They combine

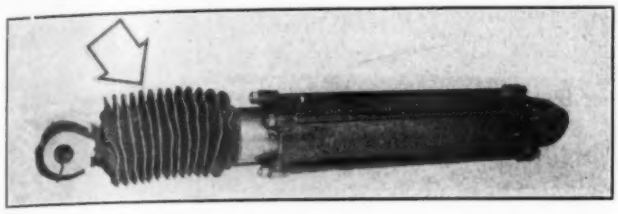


all the necessary packings, bearings, and rod-wipers into one compact unit, which can be installed or replaced by totally inexperienced mechanics within a few seconds. They consist of a bronze housing, containing "Monopak" metallic packings, "Seal-Guard" rod wipers, and bronze bushings, and are confined in the cylinder head by means of a commercial snap-ring which is readily accessible from the outside. No adjustment of any kind is necessary, either before, during, or after the initial installation, and once in place they cannot be tampered with in any way. Available for light or heavy duty service in three distinct designs, for rod sizes ranging from ⅝ to 3½ in diameter.

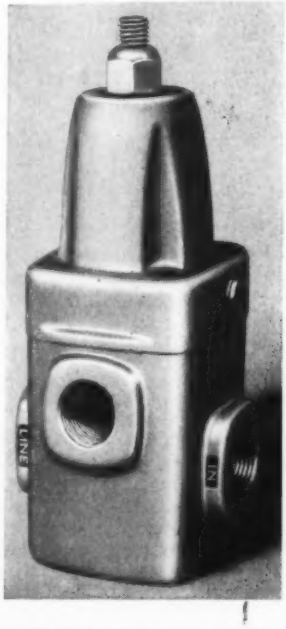
Circle 108 on Reader Service Card

TELESCOPING SLEEVES FOR CYLINDER ROD PROTECTION—Piston rods of power cylinders operating in dirty conditions can be protected from abrasion by a new type accordian sleeve offered by A & A Mfg. Co. These sleeves were developed to protect rams, rods, boosters and shifting devices for valves.

Where a moving rod is exposed to dirt, a telescoping sleeve can provide protection. Sleeves are supplied of material to meet specific service conditions of temperature and contaminants. Supplied for angular, horizontal or vertical service, the sleeves can be made in sizes to 24 in dia and 30 ft. long. The greater the difference between the inside diameter and outside diameter, the larger the expanded length and the smaller the closed length for a given size.



Circle 109 on Reader Service Card



HYDRAULIC UNLOADING VALVE — A new hydraulic unloading valve has been added by Rivett Lathe & Grinder, Inc., to its line of hydraulic devices. Featuring a balance piston design for close accurate fit in the valve bore, the Model 8826 unloading valve is used in oil hydraulic circuits to unload one part of the circuit at no back pressure to the tank. The valve is operated by pilot pressure from some other part of the circuit. Free flow to tank continues as long as the pilot pressure is higher than the setting of the valve. The Model 8826 unloading valve is available in sizes ¼ in to 1½ in, in two pressure ranges of 50 to 150 psi, and 500 to 1500 psi, adjustable from minimum to maximum in both ranges. An example of the Model 8826 unloading valve is its application to a high and low pressure circuit. In this instance, the output of a low pressure high volume pump and high pressure low volume pump is directed to a hydraulic cylinder at low operating pressure. When sufficient work load builds up, the pressure in the system increases and the unloading valve unloads the output of the high pressure pump while the output of the low pressure pump is still directed to the cylinder.

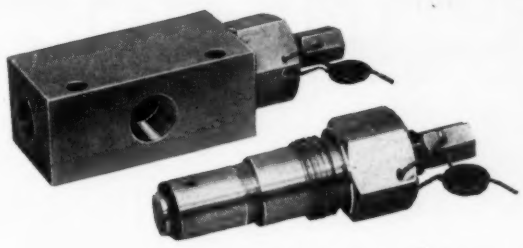
Circle 110 on Reader Service Card

PORTABLE LUBRIKIT SERVICES EQUIPMENT—A Lubrikit for the reloading of individual bearings and centralized lubricating systems on machinery in industrial plants, has been designed and built by the J. N. Fauver Company, Inc. It consists of an electrically operated barrel pump, mounted on a 400 pound grease drum for the filling of grease reservoirs; a hand transfer pump on a 100 pound drum for delivery of oil and a tool box containing hand tools, fittings and guns for servicing of individual bearings. Hose nozzles and gauges are included, mounted on steel base with rubber casters.

Circle 111 on Reader Service Card

Circle 32 on Reader Service Card

J. I. C. RELIEF VALVES



Model No. 1605.3
⅜ pipe size, cartridge type

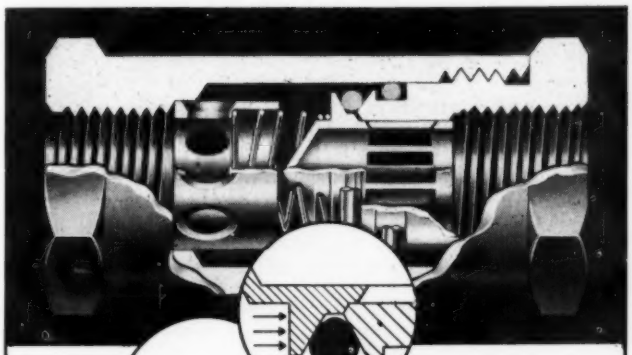
- **SILENT**
- **CONSTANT PRESSURE**

Adjustable 50 to 1000 P.S.I. Max.
or 500 to 4000 P.S.I. Max.
Max. Pressure Limited by Positive Stop to your Specification

- **ECONOMICAL**

Specify Max. Pressure and Relief Setting

FLUID CONTROLS, INC.
Box 186B Willoughby, Ohio



The CIRCLE SEAL principle insures
ABSOLUTELY LEAKPROOF performance
unequalled in any **CHECK VALVE**

Circle Seal Check Valves provide positive, bubble-tight sealing in any mounting position. The resilient "O" Ring cushions the closing shock — seals to eliminate back flow or leakage.

Pressures: 0 to 3000 psi
Temperatures: —65° F to 280° F
Sizes: 1/8" to 1"

CIRCLE SEAL
JAMES-POND-CLARK
1247 East Green Street
Pasadena 1, Calif.

precision check valves

Engineering data sent free of charge on request.

Circle 33 on Reader Service Card

Useful Catalogs and Bulletins

available for reference

Hydraulic Filter With Radial Fin Insert . . . An illustrated 4 page bulletin describes the new Staynew hydraulic filter, recently announced by Dollinger Corporation. It is designed for use wherever dirty liquids are collected and recirculated. Extreme simplicity is featured. There are only three major parts—lower end plate, insert and combined supporting tube and upper end plate with threaded outlet sleeve. The entire unit may be disassembled in 30 seconds, and insert replaced at low cost or cleaned with solvent or brush. The radial fin construction of the insert provides the largest possible filtering area in the available space. Inserts are available in many materials to meet specific filtering conditions. The basic design can be easily altered for special problems of size, capacity or liquid.

Circle 120 on Reader Service Card

Metal Bellows for Valves and Instruments . . . Valve and control instrument manufacturers and users will find complete application data for metal bellows in 30 page catalog 1200 prepared by The Fulton-Sylphon Co. Descriptive data includes a life expectancy chart based on operating pressure and stroke. Sizes and types are charted, and bellows assemblies for seals and instruments are illustrated.

Circle 121 on Reader Service Card

Valves and Cylinders for Air and Oil . . . NOPAK valves and cylinders, built by Gallend-Henning Mfg. Co. are illustrated in a 32 page Bulletin 100. Cylinder sizes and styles for four classes of construction are charted. Class 1 cylinders are for air and oil service to 150 psi; class 2, 375 psi; class 3, 650 psi and class 4 for high pressure oil applications to 1500 psi. Construction details for each class of cylinders are pictured. All four classes are offered in six standard mounting styles, with cushions in either or both ends. Drawings of valves for air and oil pressures to 250 psi and oil pressures to 1500 psi show the rotating disc design. Three- and four-way valves and shut-off valves are described with hand, foot or solenoid control. Complete dimensional and parts list data is tabulated.

Circle 122 on Reader Service Card

Photelectric Controls . . . Rugged, high-speed photelectric controls are described in Photoswitch Inc. Bulletin PA 478. Used on many hydraulically powered machines to control actuation and timing of valves these industrial units offer fast operation with sensitive adjustment. Dimensional drawings and installation specifications are given.

Circle 123 on Reader Service Card

Hose Assemblies and Couplings . . . Machine builders using high or low pressure oil systems requiring the flexibility offered by hose will get helpful data from Anchor Coupling Co. Catalog 49-S. High pressure hose for applications requiring continuous working pressures to 2000 psi is illustrated with sleeve type, sleeveless type and clamp type couplings. Hose attachments, unions, fittings and spring guards are shown a useful nomograph chart gives quick selection of hose size for given system capacity and fluid velocity. Methods of computing hose length for stationary and moveable installations will assist the builder to make proper hose selection.

Circle 124 on Reader Service Card

Synthetic Rubber Packings for Air and Oil Applications . . . Clearly diagrammed and complete with charted sizes, this new 30 page booklet prepared by Acadia Synthetic Products Division, Western Felt Works provides valuable and interesting data for the user of packings. He will find application and specification data on six styles of packings: V rings, U ring, flange, cup, "O" ring and lathe cut seals. Advantages of synthetic rubber, such as dimensional stability and close control of hardness and tensile properties are stressed. Installation data including selection of clearance, design and use of backing rings and adapters and packing protection are given. Calculations show the method of determining piston grooves for special size "O" rings.

Circle 125 on Reader Service Card

Fluid Flow Rate Testing . . . Originally prepared for company staff engineers, the Fischer & Porter Company offers a technical report containing data on new developments on fluid flow rate testing for the aviation industry. A complete discussion of engineering principles as well as detailed flow curves and charts is included and calibration techniques are described.

Circle 126 on Reader Service Card

Handbook of Technical Data on Springs . . . Designing springs is a tedious procedure which often results in a trial-and error selection. To help the user of springs to better understand basic design factors of load, deflection and space and to determine stress, diameter, wire size, material, solid height and free length, Accurate Spring Manufacturing Co. has published a comprehensive 40 page handbook. Formulas for the design of helical and torsion springs are charted and examples worked out. Complete load deflection tables with an analysis of their use are given. Convenient charted data on commercial gages and weights, and tables of wire diameters to third and fourth powers speed selection and design.

Circle 127 on Reader Service Card

Lapping of Sealing Surfaces . . . Crane Packing Company makes available a 16 page booklet which shows the application and operation of their Lapmaster machines. Readily adaptable to the lapping of valve and pump parts, the machine is available with a pneumatic lift attachment to facilitate loading and unloading. Models range in size from 12 inch diameter lap plates to 72 inches.

Circle 128 on Reader Service Card

Industrial Air Pressures to 200 psi . . . Ingersoll-Rand offers a new Bulletin describing their "T" series stationary air compressors. The "T" series consists of two lines, one designed for normal industrial pressures of 100-125 pounds; the other rated at 200 pounds for continuous service, and up to 250 pounds on intermittent pump-up service. Both lines are available as tank mounted, baseplate mounted or bare units, with electric motor or gasoline engine drive. The units are air cooled by means of fan blades integrally cast on the fly wheel. The bulletin shows various sizes and models and gives cross-sectional views engineering data, sizes and dimensions.

Circle 129 on Reader Service Card

Air Line Filter and Lubricator Gives Tool Protection . . . For equipment using 10 to 60 cfm the Keller Tool Company offers two separate units; a visible type lubricator and a pancake filter having a sintered bronze element. Described in engineering data sheets, size, construction and installation data are covered.

Circle 130 on Reader Service Card

Protect Hydraulic Equipment . . . How to stop downtime, mechanical failures and expensive repairs on hydraulic equipment caused by contaminated hydraulic oils is answered in a specially prepared 8-page bulletin published by the Honan-Crane Corporation. Titled "Stop Downtime and Expensive Repairs on Hydraulic Presses, Machine Tools, Etc." the new bulletin presents correct method and equipment to maintain hydraulic oil in its original condition for indefinite periods under the most severe operating conditions. Explains how Honan-Crane hydraulic oil purifiers remove all types of contaminants to provide longer safe use of hydraulic oils and greatly reduce oil consumption. Actual plant photographs and schematic drawings illustrate various applications of Honan-Crane purifiers, employed as a mobile unit to serve several machines, direct connected for individual machines, and used as a part of a central oil system.

Circle 131 on Reader Service Card

Valve Coupling for Hose . . . For control of air flow at any hose coupling point between the compressor and actuated device, C. B. Hunt & Son describes their valve couplings in Bulletin 104-C. Dimensional and parts data will help to select the proper coupling giving the convenience and savings of time which use of these couplings makes possible. Offered in sizes from ¼ to ¾ in, these rugged couplings have safety interlocks which prevent damage from air tools not properly exhausted and from whip of hose ends discharging live air to atmosphere.

Circle 132 on Reader Service Card

Clean and Dry Compressed Air . . . The Airdifier, manufactured by Logan Engineering Co. is described is a new Bulletin, 1150. Construction of this compact unit which centrifugally removes contaminants is shown in a cutaway view. A selection chart is based on line pressures to 150 psi and capacities to 17000 cfm. Action of the rotors cleans and dries the air while cleaning itself, giving a long service life. Installation data is included in the bulletin.

Circle 133 on Reader Service Card

Ultra-high Pressure Equipment — 100,000 psi . . . Superpressure Division of American Instrument Co. has compiled an 87 page Catalog 406 describing equip-

STOP downtime and expensive repairs on your HYDRAULIC equipment

GET THIS HONAN-CRANE BULLETIN NOW!

Tells how Honan-Crane Hydraulic Oil Purifiers, by continuous removal of contamination from oil—

- prevent excessive wear of hydraulic pump parts
- prevent clogging and sticking of control valves, pistons, and other hydraulic mechanisms
- provide longer safe use of hydraulic oils
- greatly reduce oil consumption

also gives correct applications of Honan-Crane Hydraulic Oil Purifiers to all types of hydraulic equipment.

Savings in oil alone pays cost of installing Honan-Crane Hydraulic Oil Purifiers

HONAN-CRANE CORPORATION
102 Wabash Avenue, Lebanon, Indiana
a subsidiary of
HOUDAILLE-HERSHEY CORP.

ment for the application of pressures up to 100,000 psi. Various types of valves, gages, pumps, filters and other system accessories are described. While much of this equipment is for laboratory applications and chemical processes, the components present some interesting possibilities for the solution of industrial and aviation problems.

Circle 134 on Reader Service Card

Handbook on Hydraulic Oils . . . Prepared by the research staff of E. F. Houghton & Co., this informative booklet is again offered to users of hydraulic oils. Chapters discuss oil specifications, additives, trouble shooting and flushing procedure. Importance of viscosity, viscosity index, gravity and other oil properties is clarified. Typical difficulties encountered in hydraulic systems are charted along with suggestions for correction.

Circle 135 on Reader Service Card

Carbon for Switches, Sealing Rings, Specialties . . . Stackpole Carbon Company has prepared an interesting 40 page brochure filled with application ideas and technical data for carbon. Of interest to the hydraulic designer are the seal ring designs, dash pot plungers, friction segments, clutch rings and low friction bearings. Six pages are devoted to a discussion of the physical and electrical properties of carbon. Structure, density, strength, heat conductivity and elasticity are several of the described characteristics.

Circle 136 on Reader Service Card

Selection Guide for Relays and Timers . . . Identification and specification data for Struthers-Dunn relays and timers are detailed in Catalog H. Relays are classified by size, contact rating and sensitivity. Divided into 10 sections the catalog describes standard power, latch and instrument controlled relays along with sensitive, sequence and some special purpose relays. Mountings, covers and housings are detailed and typical relay modification are listed. Well illustrated, this catalog is a handy selection guide for your control work on hydraulic equipment.

Circle 137 on Reader Service Card

No Pressure Drop Through Air Cleaner . . . Used for cleaning compressed air by means of centrifugal force, the Swartwout Airfuge is available in seven inlet and outlet tapping sizes, from ½ to 2½ inches. Information on the complete Swartwout Company Airfuge line is supplied in Bulletin S-13. The unit will remove 99 percent or more of all impurities from compressed air without air pressure drop. Moisture, oil, scale and other solids in the air are whirled outward to the walls of the unit where they drain down to the trap section. At the same time the clean, dry air passes unimpeded to feed line or tool, operating the equipment without danger of corrosion, wear, clogging, fire, explosion or freezing which occur with contaminated air.

Circle 138 on Reader Service Card

Compact Electrical Switches . . . A new catalog release on Linemaster Compact and Twin Compact Switches offered by Simonds Machine Company shows two switch innovations recently designed with improved actuating mechanism. Full details are given on weight, construction, applications, versatility, wiring plan, availability and electrical ratings.

Circle 139 on Reader Service Card

"Parco" is a trade name to rely on for better "O" rings. Better because the material used is precision compounded and fabricated by men with years of experience. All dash numbers of 6227, 6230 and 6290 series for commercial applications or Army-Navy installations to Specifications MIL-P-5516 (6227 and 6230) and MIL-P-5510 (6290) are available from stock. Silastics, Kel-F, and other special compounds are available on order.

Catalog and engineering data on request. Write us today.

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2100 Hyde Park Blvd., Los Angeles 47, Calif.
919 No. Michigan Ave., Chicago, Ill.

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Circle 35 on Reader Service Card

if your product is ON THE MOVE—

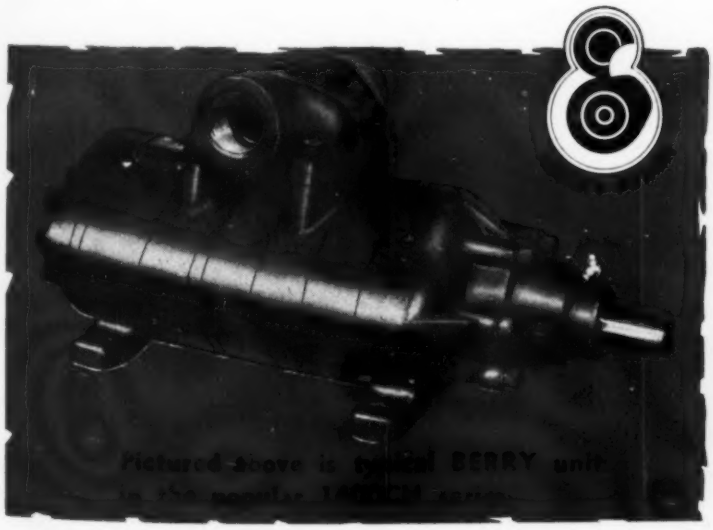
Berry hydraulics can help SMOOTH the way

For those who design and manufacture mobile equipment where *lazy horsepower* could be put to useful work, the new BERRY hydraulic power transmission system is the answer to your needs. The hydraulic units in this system may serve either as a pump or as a fluid motor, with equal performance in either direction of rotation.

BERRY hydraulic pumps and motors feature simple construction, incorporating the unique rotary piston principle which eliminates frictional contact between operating parts and their mating members. Among the outstanding features are:

—high variable input or output speeds
—smooth, positive, pulsationless power delivery
—dependable performance, long life, minimum upkeep
—instantaneous reversibility

Mobile trucking carriers such as liquid fuel transports, refrigerated trailers, armored equipment, truck winches, portable conveyors and drilling rigs, and others make use of BERRY hydraulic power transmission systems to get greater efficiency at less cost.



Immediate Delivery In Limited Quantities of Most Models

SPECIAL ENGINEERING SERVICES

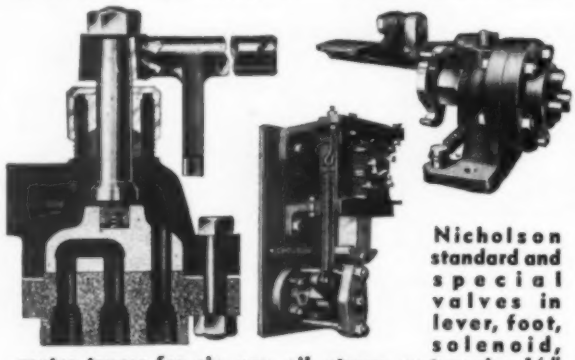
Why not let the BERRY hydraulic engineers help you plan your next move toward greater utility through the use of smooth hydraulics? An inquiry stating your requirements, will bring full particulars.

BERRY MOTORS, INC.
CORINTH, MISSISSIPPI

Circle 37 on Reader Service Card

NICHOLSON CONTROL VALVES *feature*
EASY MAINTENANCE

A survey of maintenance men shows 6 reasons for the increasing standardization on Nicholson cylinder control valves:
1) Specially treated hard seats that don't cut out.
2) Seating surfaces are protected from dirt and grit.
3) Metals, gaskets and gland packing to suit the service.
4) Generous stuffing box, easily repacked.
5) Heavy-bodied, take abuse.
6) Simplicity of design, minimizes maintenance time.



Nicholson standard and special valves in lever, foot, solenoid, motor types; for air, gas, oil, steam, water; size ¼" to 2½" press. to 5000 lbs. CATALOG 1250

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New Book

Positive Displacement Pumps and Fluid Motors

Warren E. Wilson, *250 pages, published by Pitman Publishing Corporation.*

Design engineers, confronted with problems of positive displacement pump and motor selection and construction, will find this book a good source of information.

To gain the most use from the design and computation methods, the reader will require a sound background in mathematics. But, while design and mathematical theory are emphasized, practical application of all types of positive displacement units are presented. Problems of slip, cavitation, compressibility and friction are related to pump operation.

Wilson classifies pumps and motors in two general classes—piston and rotary. Piston units include radial and reciprocating types; gear and vane construction pumps are rotary types.

Photographs and diagrams are used to illustrate construction and operation of a representative group of commercially available pumps and motors. Performance curves are plotted. A selection table for pumps provides a guide based on capacity and pressure requirements. Experimental data, elementary performance characteristics and elements of fluid flow provide the reader with tools for applying the procedures of design which are outlined in a "Design Methods" chapter.

Theory of hydraulic clutches and transmissions are the topics of the final chapters.

Useful Catalogs

(Continued from page 68)

Advantages of Synthetic Fluids . . . Ucon Hydrolubes are discussed in a 12 page brochure released by Carbide and Carbon Chemicals Division. Applications where high fire resistance of the oil is required are presented along with a series of test results. Information on how to use this fluid includes maintenance tips, filtering methods and installation procedure.

Circle 140 on Reader Service Card

"Doing Right By Your Oil System" . . . Here are facts on oil maintenance, instructions for cleaning systems, tips on oil testing and draining presented in an 18 page booklet prepared by Sun Oil Company. The booklet includes complete trouble shooting charts. Cartoon illustrated, written from a practical down-to-earth viewpoint, this pocket-size guide is aimed to help foremen and operators protect vital equipment.

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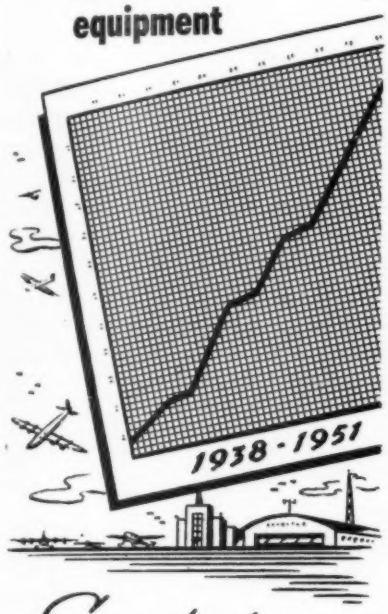
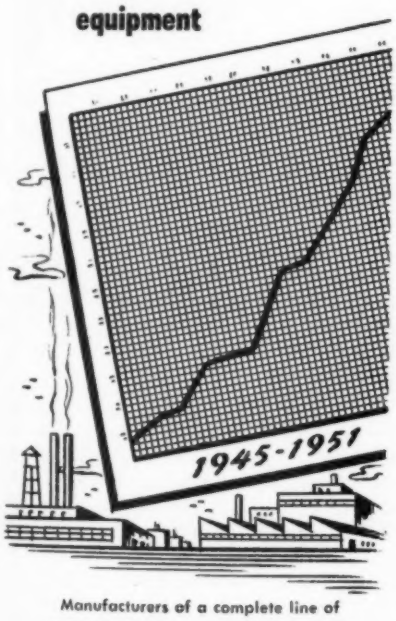
Specified
increasingly on air-borne equipment



Specified
increasingly on industrial equipment



Manufacturers of a complete line of
PRESSURE ACTUATED SWITCHES

MELETRON CORPORATION
950 NORTH HIGHLAND AVENUE
LOS ANGELES 38, CALIFORNIA
Circle 39 on Reader Service Card

Main - Ten - Ends

End 10. **Make use of the repair or service department of the manufacturer of your hydraulic equipment on any maintenance problem you are not able to handle.**

Give the manufacturer as much information as you can about the conditions under which the failure occurred. Ask for a report on the condition of the unit. This report may be helpful to your maintenance men in avoiding similar trouble in the future.

Have one of your maintenance men work with the equipment manufacturer's servicemen.

THE MARKET PLACE

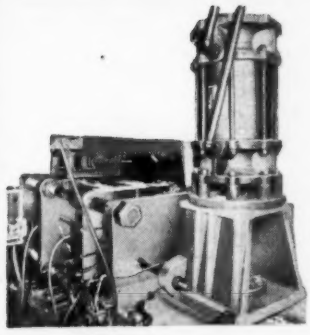
Classified Advertising

Rates: For "Positions Wanted" $4.00 minimum, limit 25 words. For all other classifications $4.50 minimum for 25 words, each additional word 15c; bold face type or all capitals, $7.50 minimum for 25 words, each additional word 20c; limit 50 words. Box addresses count as five words.

MANUFACTURERS REPRESENTATIVES AIR VALVES
Territories open in New England, Southern States, Chicago and Illinois areas on exclusive basis. Must have background, contacts, and ability to properly present a line that will shortly be the leader in the pneumatic field. Write Box 4151 Applied Hydraulics. Present representatives advised.

Engineering sales representatives wanted in principal cities to handle complete, quality line of air and hydraulic cylinders. Write in confidence, stating lines now being handled, territory covered and references. Address Box 4251 APPLIED HYDRAULICS.

Ledeen **cylinders improve the job**



CYLINDER SPEEDS DIE CAST PRODUCTION CYCLE

An increased rate of die cast production and a definite product improvement are made possible by the use of this standard 12" diam. x 8" stroke Ledeen *Super Duty* Cylinder, operating from plant air supply of 100 P.S.I.

Cylinder supplies injection power to force molten metal into the die. It replaces the usual screw-type injector, and gives faster, more positive injection improving castings and increasing production. Other similar, but smaller, casting machines employ Ledeen cylinders of 8" diam. x 6" stroke.

Standard Ledeen cylinders and mounting attachments are available from distributors' stock in major cities. Special cylinders on order.

Write for New Bulletin 500.

There are Ledeen *Medium Duty, Heavy Duty* and *Super Duty* cylinders for air, oil or water operation ready to help you, wherever you have to push or pull • lift or lower • press or squeeze • tilt or turn • open or close

Meet JIC Standards

Ledeen Cylinders are Good Cylinders • Ledeen Cylinders are Good Cylinders • Ledeen Cylinders are Good Cylinders • Ledeen Cylinders are Good Cylinders •

Ledeen **Mfg. Co.**
1610 S. San Pedro St.
Los Angeles 15, Calif.
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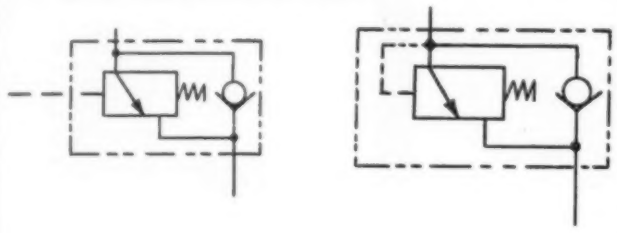
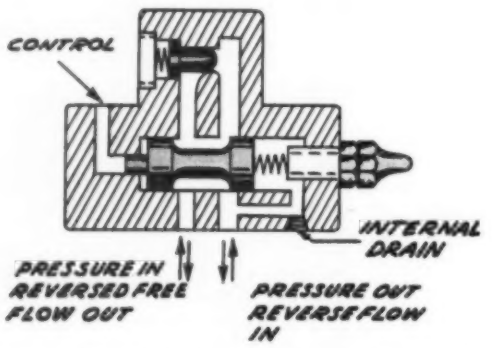
Know Your Component Symbols

Counterbalance and check valve—JIC symbols showing direct and remote control.





Schematic of the counterbalance valve. The check valve provides free reverse flow.

COUNTERBALANCE VALVES

Hydraulic Series

The fourth in a series showing the symbol and a typical schematic of the valve it represents.

Counterbalance valves are used to maintain a backpressure which opposes the oil pressure on the work load. Maintaining a backpressure on an oil cylinder will prevent lunging of the piston when the work load is quickly relieved, as, for example, when a piston driven drill breaks through the work.

The counterbalance valve may be remotely or directly controlled. Oil entering the pressure port is blocked until control pressure exceeds spring setting to move the spool and permit oil to discharge. Note that counterbalance valves are internally drained.

A check valve is included to provide free reverse flow to return the work cylinder.

Standards File Sheet

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High Pressure
SWIVEL JOINTS
Flexibility for
HYDRAULIC PIPING, TUBING!

- **AIRPLANE TYPE** — First developed for use on large planes; now widely applicable to industrial hydraulics.
- **FOR BETTER ENGINEERING!** Put flexibility where you want it—without the nuisance of sagging, flopping non-rigid lines. No expansion under pressure. 360° swivel action, with or without side flexibility. No binding. Functions perfectly at extremely low temperatures.
- **SMALL, LIGHT, COMPACT** — Many styles and sizes, ⅛" up. Pressure ratings to 3,000 p.s.i., or higher under certain conditions.
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HYDRAULIC (OIL) CYLINDERS

MANY ADVANTAGES

MANY STYLES AND SIZES

Modern in design and appearance, Vickers Hydraulic Cylinders are built for longer, more satisfactory service in oil hydraulic systems. Polished rods, honed cylinders and self-adjusting packing minimize friction. Universal mounting positions, "O" Ring gaskets, piston rod wiper, multiple piping positions are other features. Adjustable integral cushions available in all types. There is a Vickers Cylinder for *your* job.

Write for BULLETIN 49-55

VICKERS Incorporated
Division of The Sperry Corporation
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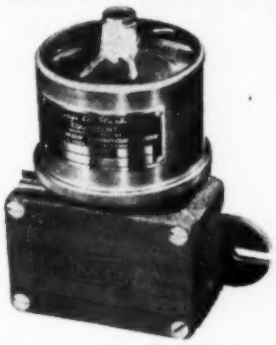
MELETRON

PRESSURE ACTUATED SWITCHES *for* EXPLOSIVE ATMOSPHERES



Accurate response to *any* pressure or vacuum change may be achieved with safety in atmospheres containing vapors of ethyl, ether, gasoline, alcohol, acetone, petroleum, naphtha, lacquer solvents as well as natural gas or grain dust.

Meletron explosion-proof models incorporate U.L. approved Micro-Switches. Pressure elements are adjustable in the field without exposing the circuit.

Meletron is your electric-hydraulic link.

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PROTECTS YOUR CYLINDER RODS, MACHINE SPINDLES, GUIDE PINS AND LOCATING PINS

The "Seal-Guard" Metallic Rod Wiper affords permanent protection from falling or flying debris . . . Two flexible bronze rings mounted in synthetic rubber lift off harmful substances completely by means of their knife-edged conical surfaces . . . The device is self-adjusting through action of rubber on staggered scraper rings . . . Rod diameter sizes are from ½ to 10 inches.

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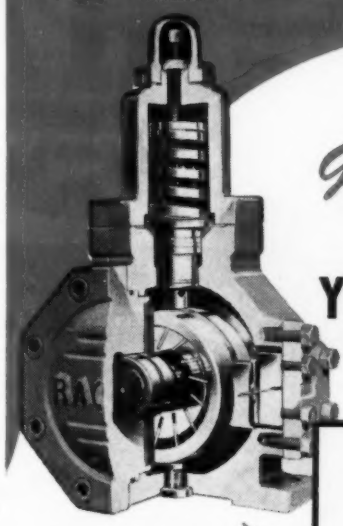
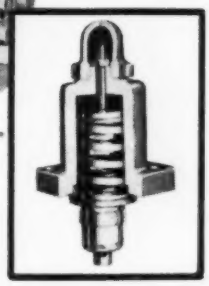
439 E. Fort St. • Detroit 26, Mich.

Put ALL of the Oil to Work



Get the Most **OUT OF YOUR CIRCUITS**



Interchangeable Governor Controls

At right is illustrated a standard pressure-compensating governor used in RACINE Pumps. Many other governors, some shown on the variable volume pumps illustrated below, are available for manual, mechanical, hydraulic or electric operation.

Top circuit efficiency demands effective regulation of volume and pressure. RACINE Pumps are all equipped with built-in governors — an exclusive RACINE feature. These governors regulate pressure and control the oil flow, delivering *only* the volume needed for the work of the circuit. They "put all of the oil to work." No by-passing — no relief valves — heating is reduced — horsepower conserved.

Governor-controlled RACINE Pumps give you efficiency, flexibility, and economy over a wide range of circuit conditions. Why not review the advantages "Variable Volume" offers for machines in your plant and for your product.

With Standard Spring Pressure Compensating Governor
With Manually Operated Volume-Control Governor
With Hydraulically Operated 2-Pressure Governor
With Solenoid Operated 2-Pressure Governor

Write for your copy of our new 3-color Hydraulic Equipment Catalog. Address Racine Tool & Machine Co., 1774 State Street, Racine, Wisconsin.

RACINE

STANDARD FOR QUALITY AND PRECISION

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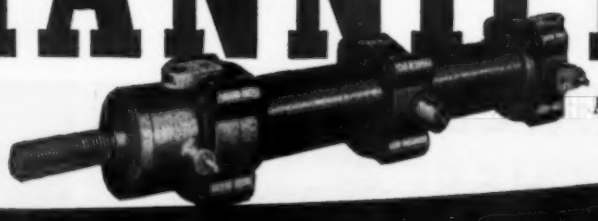
HANNIFIN



Model DDN Hydraulic Cylinder

Have You Called in Your Hannifin Engineer?

HERE is the man who can help you with *all* of your cylinder problems. He is your nearby Hannifin Factory-Trained Sales Engineer! He has had broad personal experience in the selection, installation, and use of cylinders—backed by Hannifin's own 46 years of specialization in building fine cylinders for every purpose.

Your Hannifin Representative can give you the benefit of selection from one of the most extensive lines of cylinders available to industry today: Hydraulic Cylinders in standard sizes from 1″ to 8″; Air Cylinders, 1″ to 16″ —wide choice of mounting styles; any length stroke; adjustable cushions for head end, rod end, or both. Larger or special types on order.

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Walter Erskine, Box 72, Traffic Station. *Tel. Midway 7992.*

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BULLETIN 210 "Hannifin Pneumatic Cylinders"

Model CLW Air Cylinder

CYLINDERS

POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

Howard C. Moncrieff, president of **Swan-Finch Oil Corporation**, has announced the appointment of **Anthony J. Zino, Jr.**, as assistant to the president. Zino was promoted from sales promotion manager and chief lubrication sales engineer.

A. J. Weatherhead, Jr., president of **The Weatherhead Company**, has announced the appointment of **James M. Baker** as vice president in charge of manufacturing. Baker comes to Weatherhead with a thorough background in factory management. Prior to his recent Weatherhead appointment, he was factory manager at Motor Products Corporation of Detroit. **Harry L. Adams**, formerly in charge of production, continues as vice president and will direct his attention to special assignments.

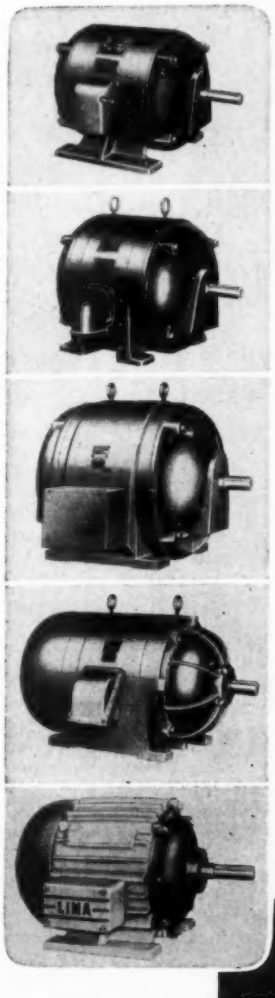
James M. Baker

The Hilliard Corporation has announced the appointment of the **Betz Engineering Sales Company**, 1225 Magazine Street, New Orleans, as a new representative. They cover the territory of Louisiana, Mississippi, and Southern Arkansas.

Certain types of heat transfer products of **Young Radiator Company** are now being manufactured in Canada under special license arrangements granted **James B. Carter, Ltd.**, Winnipeg.

James-Pond-Clark of Pasadena, California has appointed three stocking-distributors: The **Norman Engineering Company**, 2035 W. Charleston, Chicago, Ill., covering Northern Illinois, Southern Wisconsin, Northeast Indiana and East Iowa. The **Nielsen Hydraulic Equipment, Inc.**, 298 Lafayette Street, New York 12, N. Y. covering Northern New Jersey, Eastern New York, Connecticut and Berkshire, Mass. The **Scott Equipment and Engineering Co.**, 1316 Lorain Avenue, Dayton, Ohio, covering the southern half of Ohio.

Construction is in progress on the new, modern plant of the **C. A. Norgren Co.** The new structure will be built on a 3½ acre tract in Englewood, a suburb of Denver, Colorado and will provide more than twice capacity of present facilities.



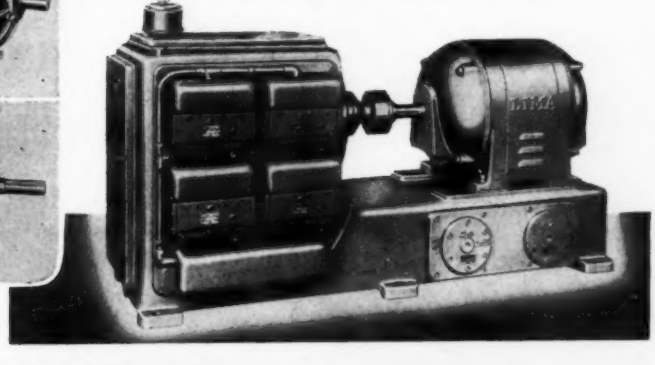
LIMA MOTORS have *built-in* DEPENDABILITY

● Ruggedly built for "tough" industrial applications, LIMA MOTORS are piling up records of outstanding dependability in progressive industrial plants throughout the world.

Original equipment manufacturers, quick to observe the performance of these motors, are specifying LIMA for their products.

Prompt deliveries on ratings of 1/3 to 150 HP, with Dripproof or Totally Enclosed frame construction.

Photo below shows a LIMA Dripproof Motor, direct-coupled to a BARNES L Type Hydraulic Unit—an original equipment application.



LIMA ELECTRIC MOTORS

WRITE TODAY FOR BULLETIN MB-1

Representation in principal cities

THE LIMA ELECTRIC MOTOR COMPANY

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PROMET THE Engineered BRONZE

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BEARING PLATES
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CONNECTING RODS
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machined or rough cast and of the specific formula best suited to the application.

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Send blueprints, conditions of operation and other data for recommendations and quotations.

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UNBRAKO

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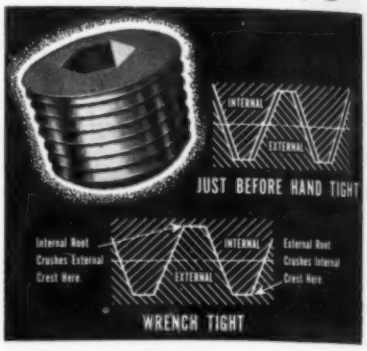
THREAD

PRESSURE PLUG



SEALS TIGHT WITHOUT COMPOUND

Unique thread design of UNBRAKO "DRYSEAL" Pressure Plugs provides positive sealing at both major and minor diameters of threads, preventing spiral leakage, even under extreme pressures. Full range of sizes from 1/16" to 1¼" N.P.T.F.

Write for Bulletin 675.

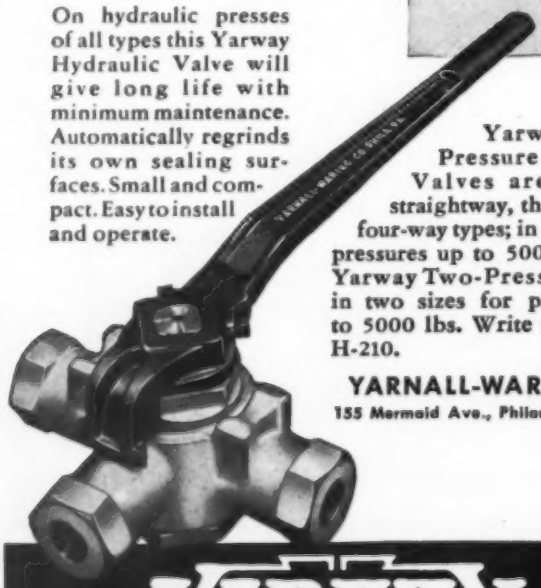
—SPS—

STANDARD PRESSED STEEL CO.

JENKINTOWN 2, PENNSYLVANIA

The Higher the Pressure ...the Tighter the Valve

On hydraulic presses of all types this Yarway Hydraulic Valve will give long life with minimum maintenance. Automatically regrinds its own sealing surfaces. Small and compact. Easy to install and operate.



Yarway Single-Pressure Hydraulic Valves are made in straightway, three-way and four-way types; in five sizes for pressures up to 5000 lbs. Also Yarway Two-Pressure Valves in two sizes for pressures up to 5000 lbs. Write for Bulletin H-210.

YARNALL-WARING CO.

155 Mermaid Ave., Philadelphia 18, Pa.

YARWAY

Improved Type HYDRAULIC VALVE

Circle 48 on Reader Service Card

SAVE UP TO 85% in WAR SURPLUS HYDRAULICS

SPECIAL BARGAIN #29 HYDRAULIC CYLINDER

Gives 20,000 lbs. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lbs. thrust with 3,000 lbs. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1¾" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road farm and shop machinery, presses, etc. Cost Government $390.00 . . . . . NOW 37.50

HYDRAULIC CYLINDERS

NO. 3A – Bore 1½", Shaft ⅝" Stroke 5", Length 10½" 5.75
NO. 9E – Bore 1-3/8", Shaft 1" Stroke 15-5/8", Length 15¾" 8.50
NO. 3S – Bore 1½", Shaft 1" Stroke 26", Length 23½" 15.75

AN-Hi-PRESS. HOSE (FUEL – OIL & AIR)

1/4" Tube Size – 7/16 x 20 Thread – 16" long with Male and Female fitting at either end. . .95¢ each.
1/4" Tube Size – 7/16 x 20 Thread – 22" long with Female fittings at both ends. . . . . .95¢ each.
3/8" Tube Size – 9/16 x 18 Thread – 20" long with Female fitting at both ends. . . . . $1.90 each
Same as above but 63" long. . . . . $3.75 each
1/2" Tube Size – 3/4 x 16 Thread – 24" long with Female fittings at both ends. . . . . $2.65 each.
Same as above but 67" long. . . . . $3.75 each.
5/8" Tube Size – 7/8 x 14 Thread – 15" long with Female fittings at both ends. . . . . $2.25 each.
Same as above but 36" long. . . . . $2.95 each.

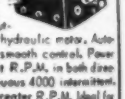
FOUR WAY VALVE

V-2B – Poppet Type. Off at neutral position. 3/8" AC Tube Ports – (9/16 - 20) thread. P.S.I. 7,500 . . . . . 4.75

V-17 – Poppet Type. Pressure balanced. Offset neutral position. Piston type with built-in relief valves for limit of cylinder strokes. ½" Standard pipe inlet & outlet ports. ½" AC tube to cylinder (⅝" - 18) thread tapped ports. NEW 8.75

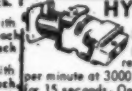
We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for inform.

HYDRAULIC TRANSMISSION



Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever.) supplying piston hydraulic motor. Automatic pressure, Dash pot for smooth control. Power output R.P.M. – 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 37.50

HYDRAULIC PUMPS



ANGLE PUMP

Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM, intermittent maximum 4500 RPM. Rotates to the right only. . . . . NEW 17.50

P-3 STRATO POWER PUMP With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. Two gal. per minute capacity at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous. 1400 PSI for 15 seconds. Operates at 3750 RPM, intermittent max-4500 RPM. Rotation either direction without adjustments. NEW 17.50

GEROTOR TYPE PUMP

Logan Gerotor type. For operating hyd. systems on tractors, trucks industrial machinery, etc. Delivers 8 GPM, at 1200 RPM, at 1000 PSI with 5 HP. Can also be used as Hydraulic Fluid Motor. Has 3/8" stnd. pipe ports, ½" splined shaft for pulley or direct attachment. 5½" dia. x 7" lg. Used but guaranteed condition. Now ONLY 22.50

PALLEY SUPPLY COMPANY

9321 San Fernando Rd. Dept. A-4 Glendale 1, Calif.

– WRITE FOR 951 CATALOG – OVER 200 PAGES OF BARGAINS in machine tools (taps, drills, dies, reamers, etc.). Hydraulic Cylinders, Valves, Pumps & Motors. Air Tools & Bearings.

Circle 75 on Reader Service Card

Charles C. Signier, vice president of the Cleveland Trust Company, has been elected chairman of the board of **The Parker Appliance Company.** Signier succeeds Herbert I. Markham, partner of Paul H. Davis & Company, Chicago, who has held the post since 1945.

C. C. Signier

Appointment of **Wenzel A. Lindfors** as factory representative for the **New York Belting and Packing Co.** in Minnesota, northwest Wisconsin, North and South Dakota and northern Iowa, was announced today by B. F. Ruether, vice president.

The Board of Directors of **Automatic Switch Company** has elected the following officers: **W. F. Hurlburt, Sr.,** chairman of the board; **W. F. Hurlburt, Jr.,** president; **H. V. Darrin,** vice president and secretary; **David M. Darrin,** vice president and treasurer.

Sealol Corporation of Providence, R. I. has announced the formation of a subsidiary company, **Sealol Manufacturing Co.** to be located in Keene, N. H. Research engineering, and sales will continue to be handled by Sealol Corporation at Providence.

R. B. Werey, president, has announced the appointment of **John C. Koch** to vice-president in charge of sales of the **Conoflow Corporation.**

Election of **Charles H. Wagner** as vice-president and director was announced today by **E. E. Yaggy, Jr.,** president of the **Gerotor May Corporation.**

Greer Hydraulics, Inc., Brooklyn announces the appointment of **Harold E. Webb,** 918 North Kenilworth Ave., Glendale, Calif., as its west coast sales and service representative.

George J. Deeb, Jr., announces the formation of **Precision Piston Rings of Indianapolis** with offices at 1308 North Capitol Ave., Indianapolis 2, Ind. Production is underway on stainless steel piston and sealing rings for both aviation and industrial use.

The **Johnson Corporation** of Three Rivers, Michigan has announced a change in representation on the west coast, effective January 1, 1951. **Guy L. Warden & Sons,** formerly district representatives for Johnson in lower California,

- - THE STANDARD OF QUALITY IN

ARROWHEAD "O" RINGS

This high standard of quality is possible because of Arrowhead's years of experience in the precision molding of "O" rings. Vigilant quality control from rubber compounding to finished product, and rigid inspection procedures constantly maintain this standard.

Standard "O" Rings Arrowhead "O" rings are available from stock in all sizes and in both Commercial and AN grades. In both grades are types designed for applications involving reciprocal motion, partial rotation and static sealing in both hydraulic and pneumatic uses.

Special "O" Rings For unusual requirements of temperature, resistance to highly corrosive substances, or other highly specialized operating conditions, Arrowhead's research laboratory will develop special compounds to meet the particular requirement.

Whatever the sealing problem, Arrowhead engineers and rubber technicians will welcome the opportunity to offer advice and assistance.

WRITE FOR "O" RING MANUAL

This valuable booklet contains comprehensive data on the use and installation of "O" rings, as well as illustrated information on the design of mechanisms for the proper use of this type seal.

Write today for Catalog 502A

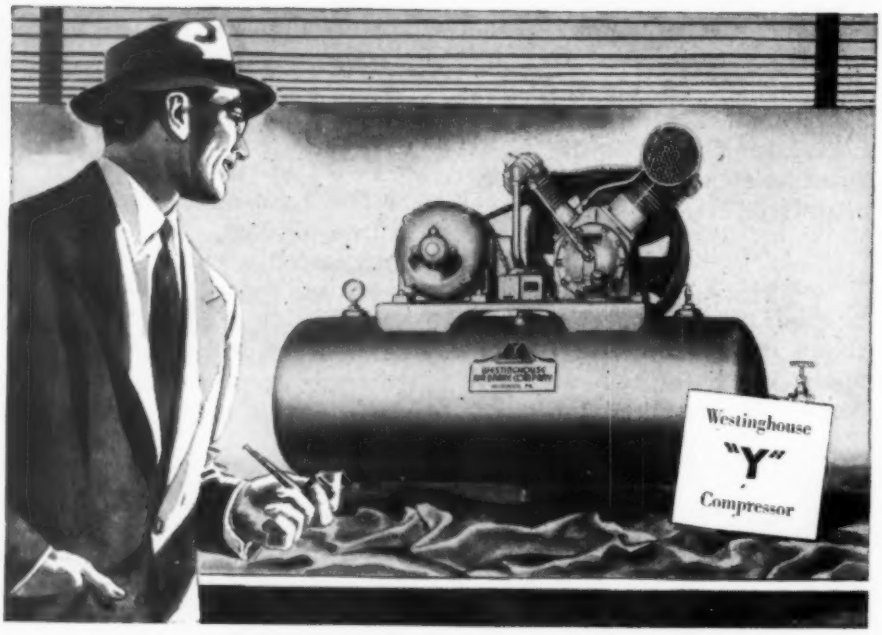
ARROWHEAD RUBBER CO.

DOWNEY (Los Angeles County) CALIF.

DIVISION OF NATIONAL MOTOR BEARING CO., INC.

Sales Engineers in Principal Cities

"O" RINGS • SILICONES • PRECISION MECHANICALS • AIRFOAM DUCTS



When shopping for Production Aids—

Here's a Checklist you can follow!

☑ *the Westinghouse "Y" Compressor*

Cut costs, boost efficiency, eliminate complication—Departmentalize your air supply—install a Westinghouse "Y" in each work area. Operate only when required . . . eliminate cost and complexities of pipe network.

Westinghouse "Y's" give you the famous "Engin*aired*" features: 1) Controlled Pressure Lubrication; 2) Low Oil Level Protection; 3) Thermal Overload Protector. Write for Bulletin IDC 9302-3.

☑ **FLEXAIR® VALVES**

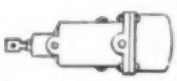
Give graduated control for clutches, cylinders, etc. Supplied in different styles for one to four pipe control.

☑ **H-Type CONTROLAIRS®**

Single and double Valve construction for graduated pressure control. Arranged for pedal, cam or knob operation.

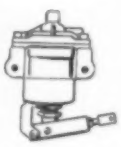
☑ **TRIDYNE®**

A three-position power cylinder.



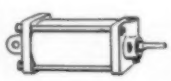
☑ **PILOTAIR® VALVE**

Single and double construction for flow control.



☑ **ACTUATORS**

Power transmitting devices used where precise positioning is required.



☑ **CYLINDERS**

Single or double acting, in 1″ to 6″ dia., with 2″, 4″, 6″, 8″ and 10″ stroke.

Westinghouse Air Brake Company's pneumatic control equipment covers the field of industrial needs. All devices designed to withstand hard service, to group readily, mount accessibly. Write for Bulletin IDA 9481-1.

Westinghouse Air Brake Co.

Industrial Products Division—WILMERDING, PA.

DISTRIBUTORS THROUGHOUT THE UNITED STATES . . . CONSULT YOUR CLASSIFIED DIRECTORY

will now cover the entire state, as well as the counties of Curry, Josephine and Jackson in Oregon. In addition to the offices at 209 West 12th St., Los Angeles 15, Calif., they have now opened offices at 5200 East 12th Street, Oakland, Calif.

The Weatherhead Company, Cleveland 8, Ohio, announces the appointment of 17 new industrial distributors in 12 industrial centers who will carry complete but varying stocks of Weatherhead products.

In New England, Weatherhead has appointed H. G. Davis, Inc., at 8 St. Mary's Street, Boston, Mass.; 195 Dewey Street, Bridgeport, Conn.; 587 Pawtucket Avenue, Pawtucket, R. I.; The Jennison Company at 87 Putman Street, Fitchburgh, Mass.

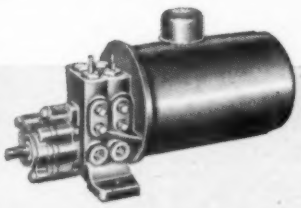
In the East: John B. Astell & Company, Inc., at 90 West Broadway, New York 7, N. Y.; Jarett Compressor & Equipment, Inc., at 275 Central Avenue, Newark 4, New Jersey; F. R. Magill Company at 44 McKnight Street, Pittsburgh 20, Pa.; Shields Rubber at 137 Water Street, Pittsburgh 22, Pa.

In the Mid-West: Gransden-Hall & Company at Walnut and Poplar, Flint 1, Michigan; Great Lakes Rubber Company at 14615 Meyers Road, Detroit 27, Mich.; Nelson & Storm Tool Supply at 718 Broadway, Rockford, Illinois; Iron Range Equipment Company at 2701 Fifth Avenue, Hibbing 4, Minn.; The Jurgens Company at 519 North Cleveland Avenue, St. Paul 4, Minn.; Riggs Engineering Company, Inc. at Box 133, Ludlow, Ky.; Vorys Brothers, Inc., at 63 East Goodale Street, Columbus 8, Ohio; F. D. Haker Company at 713 South 10 Street, Milwaukee 4, Wisc.; The Midwestern Rubber Company at 735 Carnegie Avenue, Cleveland 15, Ohio; W. S. Nott Company at Second Avenue North and Third Street, Minneapolis, Minn.

In the West: Plant Equipment Company at 1863 Wazee Street, Denver 2, Colorado.

W. A. Finn has been named general European manager of **Worthington Pump and Machinery Corporation**, Harrison, N. J. He replaces A. W. Fraser, who is assuming an executive sales position with Worthington and will make his headquarters in Chicago.

Another Job for Pesco HYDRAULIC MUSCLES



Pesco Hydraulic Power package model 05-2252-010. Pump displacement .433 cu. in. Capacity 2.75 g. p. m. @ 1600 r. p. m. @ 1200 p. s. i. Package includes relief valves, check valves, and reservoir.

See the Pesco Exhibit
Booths 117 and 118
MATERIALS HANDLING EXPOSITION
April 30 to May 4
International Amphitheater · Chicago, Ill.

PESCO POWER PACKAGE operates BOTH Hydraulic Header Lift and Variable Speed Drive on Deluxe COCKSHUTT Combine

Offering a new range in performance, never before equalled in combine design, the new Deluxe Cockshutt "Drive-o-matic" combine makes possible great savings in threshing time and a much greater yield in grain threshed.

By designing the combine so that a single unit Pesco hydraulic Power Package provides the necessary power for both lowering and raising the combine header, to compensate for variations in crop heights and ground levels, and for regulating the forward speed of the combine itself, Cockshutt engineers have made it possible for the operator to meet all harvesting conditions with finger tip control.

The preciseness, ease, and accuracy with which Pesco hydraulic muscles can handle such complicated, heavy, and sometimes awkward operations, is only one important reason why more and more farm and industrial equipment manufacturers are turning to Pesco for answers to their hydraulic power problems.

Perhaps this sales power of Pesco hydraulic power can help you, too. For the complete story, write today.

engineering Pesco production
PRODUCTS DIVISION

BORG-WARNER CORPORATION
24700 NORTH MILES ROAD BEDFORD, OHIO

Circle 51 on Reader Service Card

Guard Your Family STRIKE BACK!

GIVE to Conquer Cancer

IF SOMEONE IN YOUR FAMILY HAD CANCER, you would do anything . . . everything that would help. And today there is so much that you can do to help. Tens of thousands of families just like yours meet cancer every year and triumph over it. But we are still losing too many men and women we love.

Doctors can now cure half of those who develop cancer if the disease is diagnosed in its early stages. Yet in 1950 some 210,000 families lost a father, a mother or a child to cancer. Many of them—probably 70,000—could have been cured.

To save more lives, we all must help.

Your gift to the Cancer Crusade will help guard your family by providing more research, more life-saving education, more training for scientists and physicians, more equipment, more services for those already striken with the disease.

Cancer is man's worst enemy. Striking back at cancer costs money. Any contribution is welcome but, the fight against this major threat deserves major support: dollars—tens—twenties —hundreds of dollars. Will *you* help?

AMERICAN CANCER SOCIETY

Applied Hydraulics